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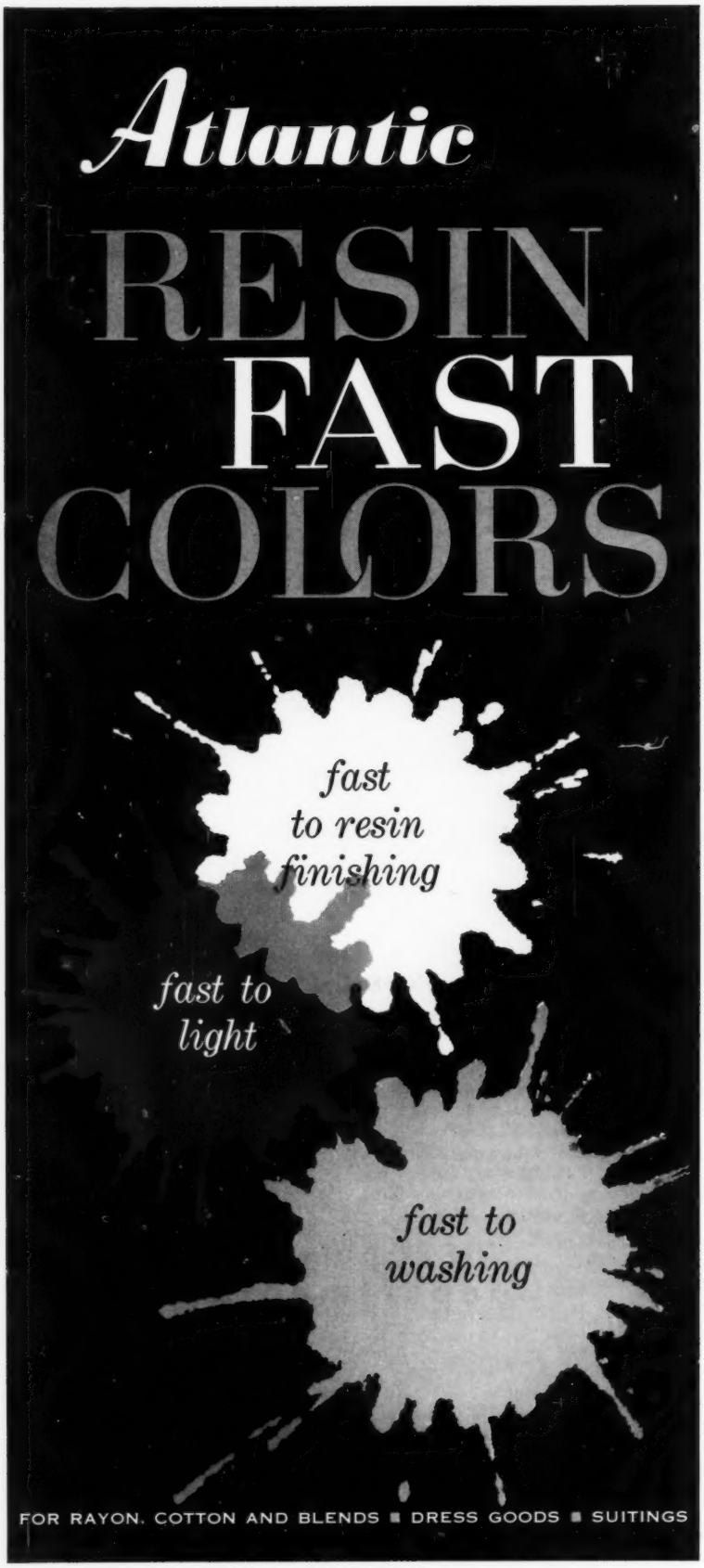
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A SCHEME FOR FIBER IDENTIFICATION WITH EMPHASIS ON NEW POLYACRYLIC, POLYAMIDE, POLYESTER AND CELLULOSIC FIBERS*

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A general scheme of qualitative fiber analysis which depends mostly upon solubility and staining behavior and color reactions is described. Special attention is given to distinguishing among the newer nylon fibers (Nylon Type 420, Nylon Type 501, Rilsan), acrylic fibers (Acrilan 16, Creslan, Darvan, Darvan X-7, Dynel 97, Orlon Cantrece, Orlon 39, Orlon 25, Verel, Zefran), polyester fibers (Dacron 64, Kodel, Vycron), cellulose triacetate (Arnel), and cellulosic fibers (Corval, Fiber 40, Fiber 500, SM-27, Topel, Zantrel).

INTRODUCTION

EACH of the past few years has been marked by the appearance in the textile industry of several new regenerated and synthetic fibers. The days when a synthetic fiber could be identified by burning and checking solubility in two or three solvents are long gone. It is difficult, now, for the individual to remember the names of all the newer fibers, much less tell them apart.

This report comprises an amplification of lecture and laboratory work done in connection with the course in Fiber Technology given at the Institute. It was felt that others in the textile industry might be able to use the data collected to good advantage.

GENERAL

The scheme of nonmicroscopic qualitative fiber analysis described herein is, in considerable measure, an expansion and adaptation of the analytical procedure described by M L Bumiller (*1*) to include all the major and most of the minor synthetic and regenerated fibers currently available in the United States. Metallic yarns and natural fibers, except cotton, flax, hemp, jute, wool, silk and asbestos, have been excluded from consideration.

This Report has been divided into three Sections.

A) METHODS OF TEST———The Methods of Test contain brief instructions for the performance of burning, solubility and staining tests. Methods for determining melting point or softening point, specific gravity, and cross-sectional appearance are briefly described because, in a few instances (acrylics, polyolefins, cellulosic fibers), burning behavior, solubility and staining are inadequate characterizations.

B) PROCEDURE FOR QUALITATIVE FIBER ANALYSIS———The Procedure for Qualitative Fiber Analysis is a written key to fiber identification. In each numbered test or group of tests two or more possible modes of fiber behavior are indicated; each possibility having a letter subscript. The analysis of an unknown fiber begins with performance of Test 1, treatment for five minutes in boiling dimethylformamide. The fiber will be soluble (1a), insoluble (1c), or mostly soluble (1b). The number of the next test to be performed, in each case, is indicated in brackets following the behavioral description. Thus, a fiber insoluble in boiling dimethylformamide, Test 1c, would next be subjected to Test 23, treatment in cold concentrated sulfuric acid. Fibers insoluble in cold concentrated sulfuric acid either sink, Test 24a, in water containing surfactant or float, Test 24b, in water containing surfactant. Those which sink are tested, Test 25, with a hot Bunsen flame to find out whether they are unaffected, Test 25a, ASBESTOS; fused, Test 25b, GLASS; or consumed, Test 25c, TEFLON. Although the Appendixes are not referred to in the text, they can be used to gain additional information on properties, solubility, and staining behavior of cellulose acetate, nylons, acrylic, polyester, and cellulosic fibers.

C) SCHEME FOR FIBER IDENTIFICATION———This Section is merely a schematic representation of the material presented in Section B.

A complete list of fibers considered in this analytical scheme is given in Table I, together with fiber type and manufacturer, if there is only one manufacturer.

Mention should be made of the fact that the composition of synthetic fibers is changed from time to time by the manufacturers and new fibers are continually being introduced. Furthermore, the analytical scheme herein described was worked out using one or a few samples of each fiber. Fibers of different denier, of different tenacity, or even from different production batches will vary somewhat in their behavior. Dyed and/or finished fibers will often react quite differently than raw fibers. Each of these factors should be given due consideration by the fiber analyst.

A short annotated bibliography of recent papers on the subject of fiber identification has been included in

*ITT Report No. 24 (revised), Jan 12, 1960. Based upon a paper presented at the Symposium—Textile Fibers (Jack Compton, chairman), Southeastern Regional Meeting of the American Chemical Society, Richmond, Va, Nov 5, 1959.

this report as Appendix VII. The reader may find it helpful to consult the articles listed for additional information on fiber behavior.

A) METHODS OF TEST

GENERAL——Dyed fibers may often be stripped by treatment with alkaline sodium hydrosulfite, Clorox, or other bleaching reagents or by extraction with pyridine. Many finishes can be removed by extraction of the fiber material with chloroform or carbon tetrachloride followed by alcohol extraction with dioxane and a short boil in dilute aqueous hydrochloric acid. This is the sequence of reagents used in the Skinkle procedure for qualitative analysis of finishing materials (*2*).

1) *Burning Test.* For the Burning Test, a twisted bundle of fiber an inch or two long is inserted in the flame of a Bunsen burner. If the fibers soften and shrink, maintain them in contact with the flame until some of the material chars and burns to ash or it becomes obvious that the fibers are nonflammable.

2) *Solubility Tests.* Eighteen reagents are mentioned in this report for use in making solubility tests, of which the first thirteen listed in Table II are the minimum necessary for the complete analysis.

Solubility tests are performed by filling a standard test tube half-full with the reagent and dropping in a ball of fiber small enough to slide readily into the test tube. Between 30 and 50 milligrams of fiber should be used in five milliliters of reagent in a 13 ×100 millimeter test tube, or 100-150 milligrams of fiber in 15 milliliters of reagent in an 18 × 150 milliliter test tube. Allow about five minutes, at room temperature or after heating to the boil, as indicated in the text or appendixes, before concluding that the sample is, or is not, soluble in the reagent. Exceptions are the sulfuric acid and dimethylsulfoxide tests with acrylic fibers, Tests 3 and 7. The acrylic fibers are only slowly soluble in sulfuric acid (up to one-half hour) although they decompose within a minute or two. In cold dimethyl sulfoxide, most 1.5- or 3-denier acrylic fibers are soluble within ten minutes but others require up to 30 minutes. Heavy-denier fibers are more slowly soluble.

It is not within the scope of this report to discuss analysis of all possible fiber blends but many blends can be analyzed without resort to microscopic examination. When a dull or dyed component of a blend dissolves in a solvent, the latter will become cloudy or tinted. In most cases, the reagent can be examined for dissolved fiber residues by evaporating to dryness. Blends of undyed fibers can be given a preliminary test with an identification stain.

TABLE I

Identification of fibers with chemical type and manufacturer

Name of fiber	*Textile Fiber Products Labeling Act Chemical classes*	*Manufacturer*
Acetate	acetate	(Several)
Acrilan*	acrylic	Chemstrand
Acrilan 16*	acrylic	Chemstrand
Arnel	acetate	Celanese Corp of America
Asbestos	——	——
Avril	rayon	American Viscose
Bemberg (Cupra)	rayon	American Bemberg Div, Beaunit Mills
Caprolan	nylon	Allied Chemical Corp
Corval	rayon	Courtaulds (Alabama)
Cotton	——	——
Creslan	acrylic	American Cyanamid
Dacron 54	polyester	DuPont
Dacron 64**	polyester	DuPont
Darvan	nytril	B F Goodrich
Darvan X-7***	nytril	B F Goodrich
Dynel	modacrylic	Union Carbide
Dynel 97****	modacrylic	Union Carbide
Enka nylon	nylon	American Enka
Fiber 500	rayon	American Enka
Flax	——	——
Fortisan	rayon	Celanese Corp of America
Fortisan 36*****	rayon	Celanese Corp of America
Glass fiber	glass	(Several)
Hemp	——	——
IRC nylon	nylon	Industrial Rayon
Jute	——	——
Kodel	polyester	Tennessee Eastman
Nylon	nylon	DuPont, Chemstrand
Nylon 420#	nylon	DuPont
Nylon 501#	nylon	DuPont
Orlon 42##	acrylic	DuPont
Orlon 39###	acrylic	DuPont
Orlon 25###	acrylic	DuPont
Orlon Cantrece###	acrylic	DuPont
Polyethylene (conventional)	olefin	(Several)
Polyethylene (linear)	olefin	(Several)
Polypropylene	olefin	(Several)
Rayon (viscose)	rayon	(Several)
Rhovyl####	vinyon	Rhodia, Inc (agent)
Rilsan	nylon	(Several—Import)
Rovana	saran	Dow Chemical
Saran (Velon)	saran	(Several)
Silk	——	——
SM-27	rayon	Courtaulds (Alabama)
Teflon	fluorocarbon	DuPont
Topel	rayon	Courtaulds (Alabama)
Verel#####	modacrylic	Tennessee Eastman
Vinylon	vinal	Air Reduction Co (importer)
Vinyon HH	vinyon	American Viscose
Vycron	polyester	Beaunit Mills
Wool	——	——
Zantrel	rayon	Hartford Fibers Co (importer)
Zefran	acrylic	Dow Chemical Co

*Acrilan 16 differs from regular Acrilan in not having affinity for acid dyes. It is used for cross-dyeing of all-Acrilan or Acrilan-wool blends. Regular Acrilan is also available in high-shrinkage form.

**Dacron 64 differs from Dacron 54 in that it has affinity for cationic dyes; has less pilling tendency. It is used in wool blends.

***Darvan X-7 is a more dyeable modification of Darvan.

****Dynel 97 is a carpet fiber.

*****Fortisan 36 is a new, stronger form of Fortisan.

#Nylon 420 is a low elongation fiber with initial modulus like cotton; is used for blending with cotton. Nylon 501 has a trilobal cross-section and is for carpet use.

##Orlon 42 is available in high-shrinkage form. Orlon Type 38

###Orlon 39 is a mixture of deniers and staples for wool blending. Orlon 25 is for blending with cotton. Orlon Cantrece is a dyeable filament yarn.

####Rhovyl is available in high-shrinkage form, Rhovyl 55, and in a "thermally stable" form, Rhovyl T.

#####Verel is (or was) available as Type I, low shrinkage, Type II, moderate shrinkage, and Type III, high shrinkage.

TABLE II

Reagents used in making solubility tests

Essential	*Optional*
Acetone	m-Cresol
Acid, acetic, glacial	Dimethylsulfoxide
Acid, formic, conc	Ethyl acetate
Acid, hydrochloric, conc	Nithrobenzene
Acid, nitric, conc	Toluene
Acid, sulfuric, conc	
Cupriethylene diamine, one-molar	
Cyclohexanone	
o-Dichlorbenzene	
Dimethylformamide	
Methylene chloride	
Potassium hydroxide (40% by wt in water)	
Xylene	

3) *Staining Tests and Other Color Reactions.* The six identification stains, two individual dyestuffs and one dyestuff mixture, used in fiber identification tests, are listed in Table III along with sources and details of use. (Also see Calco Techni-

TABLE III

Materials used for staining tests with details of procedure

Material	*Soln conc %*	*Acetic acid conc %*	*Time, min*	*Temp*
Identification Stain A*	0.5	0.25	3	boil
Identification Stain AH (National Aniline Div)	1.0	0	3	boil
Identification Stain GDC (General Dyestuff Co)	1.0	1.00	3	boil
Identification Stain ODDA (General Dyestuff Co)	1.0	1.00	3	boil
Calco Stain No. 2 (American Cyanamid Co)	1.0	0	1	boil
DuPont Stain No. 4 (E I duPont de Nemours & Co, Inc)	1.0	0	1	boil
CI Acid Blue 25	0.2	0.50	5	boil
CI Direct Red 75	1.0(owf)	0	3	cold
CI Acid Red 73	0.5	> 1.00	5	cold**
CI Direct Blue 15	0.5			

*Identification Stain A should contain one part each of CI Acid Blue 25, CI Disperse Yellow 3, and CI Mordant Red 78.

**Rinse lightly in warm (30°C) water, wash 15-30 *seconds* with vigorous agitation in hot (50°C) water containing a little detergent, such as Nacconol NR, rinse lightly again in warm water, and dry.

cal Bulletin No. 831, "Identification of Synthetic Fibers by Microscopical and Dye Staining Techniques," by G L Royer). Generally a 30-50:1 liquor to fiber ratio is recommended with each stain. The fibers are rinsed with warm water and air dried before examination. An invaluable aid to using identification stains is the preparation of a series of stained fibers and/or simultaneous staining of known fibers along with unknown fiber samples.

The other color reactions referred to in this report involve the use of concentrated sulfuric acid, 5% aqueous sodium hydroxide and 40% aqueous (by weight) potassium hydroxide. The Sulfuric Acid Test is carried out like a Solubility Test and the color changes are observed. The Potassium Hydroxide Test should be performed in small beakers with, for instance, only 10 milliliters of reagent in a 50-milliliter beaker. Some of the color changes occur only as the solution concentrates by evaporation. The Sodium Hydroxide Test should be done in beakers with a larger volume of reagent.

4) *Miscellaneous Tests.* Melting or softening-shrinking points of fibers can be determined on a hot plate or ordinary electric iron using known samples simultaneously with the unknown. Fiber densities are used for determining the polyolefin group of fibers. Both kinds of polyethylene and polypropylene fibers float in slightly soapy water. Fibers should be cut into short lengths (one-half inch or less) and stirred into the water in a glass or beaker. Conventional polyethylene and polypropylene fibers float and linear polyethylene fibers sink in water containing 52% ethyl alcohol by volume (density about 0.93) when the test is performed as herein described.

5) *Microscopic Examination.* Cross-sections of fibers for microscopic examination can be prepared by running a needle with a loop of thread through a small, rectangular piece of cork and stuffing fibers through the loop of thread. The fibers are then wedged into the hole in the cork and thin cross-sections of the cork cut with a razor blade. Except for acetone-soluble fibers, a little Duco cement or similar adhesive can be used to improve binding of the fibers in the cork. With experience, fibers having round, kidney-shaped, C-shaped, dog-bone, or lobed cross-section can be differentiated from one-another in longitudinal view in the microscope. Use of a microscope becomes very important when intimate fiber blends are being analyzed. Fibers of different appearance can be observed directly in longitudinal view or cross-section and subjected to solubility tests on the slide. (3)

B) PROCEDURE FOR QUALITATIVE FIBER ANALYSIS

1a) Fiber is soluble in boiling dimethylformamide. [2]

1b) Fiber is mostly soluble in boiling dimethylformamide, possibly Dacron 54, or mostly soluble, solution discolors on boiling, may reprecipitate if metal spatula used, possibly Rovana. [2]

1c) Fiber is insoluble in boiling dimethylformamide. [23]

2a) Fiber is soluble in cold dimethylformamide[1]. [3]

2b) Fiber is insoluble in cold dimethylformamide, but may gelatinize[1]. [10]

[1]Three samples of Creslan, obtained in 1960, dissolved completely in dimethylformamide at 25°C in five to seven minutes. Orlon 42, the most soluble "insoluble" fiber, required about 10 minutes for complete solution under the same conditions.

3a) Fiber is soluble in cold concentrated sulfuric acid although complete dispersion may take up to half an hour. [4]

3b) Fiber is insoluble in cold concentrated sulfuric acid. [8]

4a) Fiber is decomposed by, but insoluble in, cold concentrated nitric acid. *VEREL*

4b) Fiber is soluble in cold nitric acid. [5]

5a) Fiber is soluble in cold acetone. *ACETATE*

5b) Fiber is insoluble in cold acetone. [6]

6a) Fiber is insoluble in boiling cyclohexanone or m-cresol. *CRESLAN*

6b) Fiber is soluble in boiling cyclohexanone or m-cresol. [7]

7a) Fiber is soluble in cold dimethylsulfoxide or boiling 40% w/w potassium hydroxide. *DARVAN*

7b) Fiber is decomposed, but insoluble, in cold dimethylsulfoxide or boiling 40% w/w potassum hydroxide. (Cross-section is shown in Fig 1). *DARVAN X-7*

8a) Fiber is insoluble in boiling acetone. *RHOVYL*

8b) Fiber is soluble in boiling acetone. [9]

9a) Fiber has round cross-section cylindrical longitudinal appearance. *DYNEL 97*

9b) Fiber has C-shaped or similar cross-section, ribbon-like longitudinal appearance. *DYNEL*

10a) Fiber is soluble in cold concentrated nitric acid. [11]

10b) Fiber is insoluble in cold concentrated nitric acid. [16]

11a) Fiber is soluble in cold concentrated hydrochloric acid. *NYLON 6* (Caprolan, Enka nylon, IRC nylon).

11b) Fiber is filament, insoluble in cold concentrated hydrochloric acid. *ORLON CANTRECE*

11c) Fiber is staple, insoluble in cold concentrated hydrochloric acid. [12]

12a) Fiber is insoluble in 62:38 v/v dimethylformamide:xylene at 100°C in water bath, does not fuse in 98-100% formic acid on boiling water bath[2]. [13]

[2]ORLON 21 ("Sayelle")——A new fiber being marketed by DuPont. Orlon 21 has what is described as "reversible crimp," which reportedly improves the "wash-wear" properties of knitted and woven goods made from it. This fiber is soluble in boiling dimethylformamide, insoluble in cold dimethylformamide, soluble in cold conc nitric acid and insoluble in cold conc hydrochloric acid. Orlon 21, therefore, would be subjected to Test 12 in the

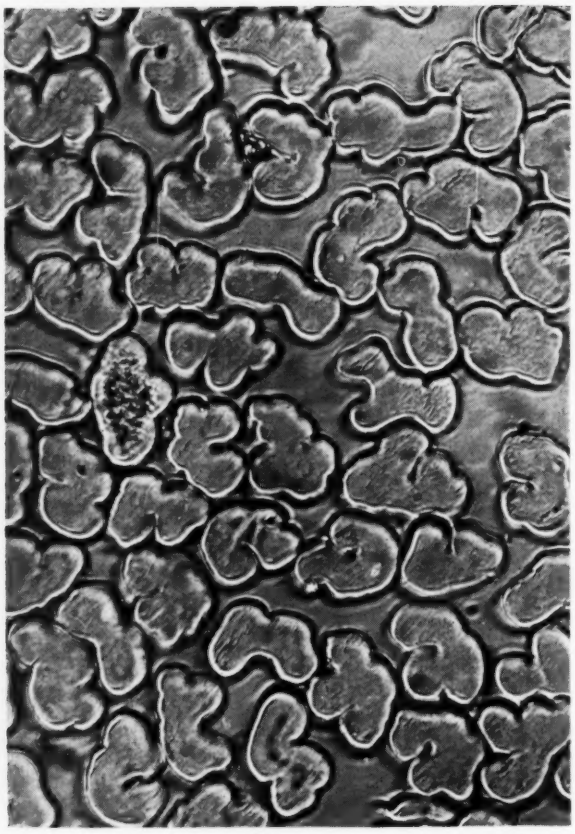


Figure 1
Darvan X-7; bright 3-denier staple

Figure 1a
Darvan; semidull 3-denier staple

12b) Fiber is soluble in 62:38 v/v dimethylformamide:xylene at 100°C in water bath, fuses partially or completely in 98-100% formic acid on boiling water bath. [14]

13a) Fiber turns orange after five-minute immersion in 5% sodium hydroxide at 85°C and is dyed pink after three-minute immersion in cold 1% CI Direct Red 75, is unaffected by conc formic acid at 100°C. *ZEFRAN*

13b) Fiber is not colored by five-minute immersion in 5% sodium hydroxide at 85°C or by three-minute immersion in cold 1% CI Direct Red 75, is swelled and weakened in conc formic acid at 100°C. *ACRILAN*

14a) Fiber has round or kidney-shaped cross-section, cylindrical longitudinal appearance with possible appearance of false lumen, and is stained yellow by three-minute immersion in boiling 1% identification Stain AH. *ACRILAN 16*

14b) Fiber has dog-bone cross-section, ribbon-like longitudinal appearance with false lumen, and is stained very pale yellowish gray by three-minute immersion in boiling 1% Identification Stain AH[3]. [15]

15a) Denier of fibers is whole number such as 1, 2, 3, etc; fibers fuse completely in conc formic acid at 100°C. *ORLON 42*

15b) Fibers have various deniers and various lengths; fibers fuse completely in conc formic acid at 100°C. *ORLON 39, 39A, 39B.*

15c) Denier of fibers is 2.5, staple is 1.5 inches; fibers fuse partially in conc formic acid at 100°C, retain fibrous form. *ORLON 25*

16a) Fiber is soluble in boiling glacial acetic acid. [17]

16b) Fiber is insoluble in boiling glacial acetic acid. [18]

17a) Fiber is soluble in cold methylene chloride. *ARNEL*

Procedure for Qualitative Analysis. The fiber is insoluble in dimethylformamide: xylene 62:38 (by vol) at 100°C and is only slightly fused in 98-100% formic acid at 100°C; thus falling into Test 12a. Orlon 21 can be distinguished from Zefran by the fact that it is not stained by cold CI Direct Red 75 and from Acrilan by its acquisition of a pale pinkish-orange coloration in 5% sodium hydroxide at 180°F (85°C). In addition, Orlon 21 stains to a pale, slightly greenish-yellow after three-minute immersion in boiling 1% Identification Stain ODDA in 1% acetic acid while Acrilan and Zefran are colored to full red shades in this stain. The three fibers also have distinctly different cross-sections. Zefran fibers are round; Acrilan fibers are round to kidney-shaped (kidney-shaped only in heavier deniers); Orlon 21 fibers are irregular in shape with, usually, three or four lobes and a characteristic appearance of a swollen dogbone with one lobe split.

[3]ORLON 37——A new fiber being marketed by DuPont. Orlon 37 is a heavy-denier carpet fiber, still experimental. Orlon 37 is soluble in boiling dimethylformamide, tends to break up slightly (within five minutes) in cold dimethylformamide, is soluble in cold conc nitric acid and is insoluble in cold conc hydrochloric acid. The fiber is soluble in the dimethylformamide:xylene mixture and fuses, but retains fibrous form (like Orlon 25), in 98-100% formic acid at 100°C. In Test 14 of the Procedure for Qualitative Analysis, Orlon 37 is stained yellow after three-minute immersion in boiling 1% Identification Stain AH but is found to have a dogbone cross-section like the other Orlons (except Orlon 21). Orlon 37 can be further distinguished from Acrilan 16 and Orlons 42, 39 and 25 by its coloration after three-minute immersion in boiling 1% Identification Stain ODDA in 1% acetic acid. Acrilan 16 is stained a pale greenish-grey. The three Orlons all take on a pinkish shade, while Orlon 37 acquires a pale greenish-yellow color. The high solubility of Orlon 37 in dimethylformamide could also be used as an identification test.

Figure 2
Zantrel; bright 1-denier staple

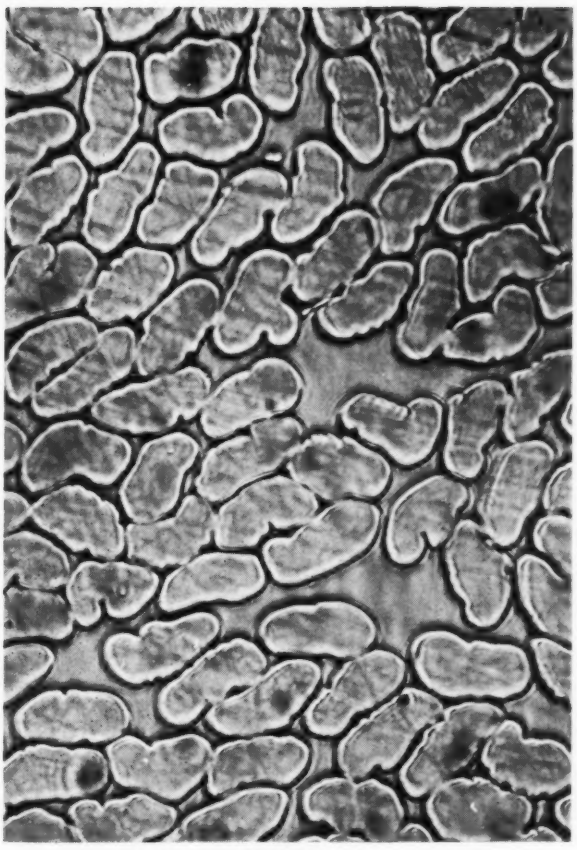


Figure 3
Fiber 500; bright 1½-denier staple

17b) Fiber is insoluble in cold methylene chloride. *RILSAN*

18a) Fiber is soluble in cold concentrated sulfuric acid. [19]

18b) Fiber is insoluble in cold concentrated sulfuric acid. [21]

19a) Fiber is almost insoluble in boiling o-dichlorbenzene and is stained pale greenish-gray after three-minute immersion in boiling 1% Identification Stain ODDA in 1% acetic acid. *DACRON 64*

19b) Fiber is soluble or mostly soluble in boiling o-dichlorbenzene and is stained pale pink after three-minute immersion in boiling 1% Identification Stain ODDA in 1% acetic acid. [20]

20a) Fiber melts at 235°C; on warming hotplate, melts before Dacron or Nylon 6,6. *VYCRON*

20b) Fiber melts at 250°C; on warming hotplate, melts with Nylon 6,6. *DACRON 54*

21a) Fiber is soluble in cold acetone. *VINYON HH*

21b) Fiber is insoluble in cold acetone. [22]

22a) Fiber is soluble in boiling toluene or xylene. *SARAN*

22b) Fiber is insoluble in boiling toluene or xylene. *ROVANA*

23a) Fiber is insoluble in cold concentrated sulfuric acid. [24]

23b) Fiber is soluble in cold concentrated sulfuric acid. [28]

24a) Short bits of fiber sink in water containing surfactant. [25]

24b) Short bits of fiber float in water containing surfactant. [26]

25a) Fiber is unaffected by hot Bunsen flame though carrier fibers may burn. *ASBESTOS*

25b) Fiber is fused by hot Bunsen flame. *GLASS*

25c) Fiber is carbonized and consumed by hot Bunsen flame. *TEFLON*

25d) Fiber is burned in hot Bunsen flame with protein odor. *WOOL*

26a) Fiber sinks in water-alcohol mixture of density 0.93. *LINEAR POLYETHYLENE*

26b) Fiber floats in water-alcohol mixture of density 0.93. [27]

27a) Fiber softens and melts at a temperature of 120°C or less. *CONVENTIONAL POLYETHYLENE*

27b) Fiber softens and melts at a temperature near 150°C. *POLYPROPYLENE*

28a) Fiber is soluble in cold concentrated formic acid. [29]

28b) Fiber is insoluble in cold concentrated formic acid. [31]

29a) Fiber is insoluble in boiling glacial acetic acid. *VINYLON*

29b) Fiber is soluble in boiling glacial acetic acid. [30]

30a) Fiber is staple, has round cross-section, is stained orange-yellow after three-min-immersion in boiling 1% Identification Stain GDC in water, is stained light red-orange after three-minute immersion in boiling 1% Identification Stain GDC in 1% acetic acid. *NYLON (6,6) 420*

30b) Fiber has three-lobed cross-section, is stained red after three-minute immersion in boiling 1% Identification Stain GDC in water, is stained

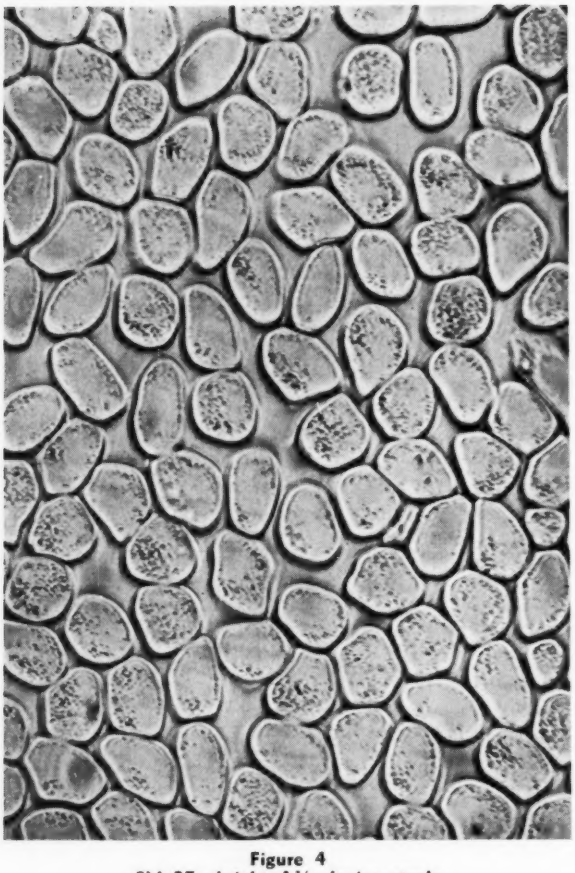


Figure 4
SM-27; bright 1½-denier staple

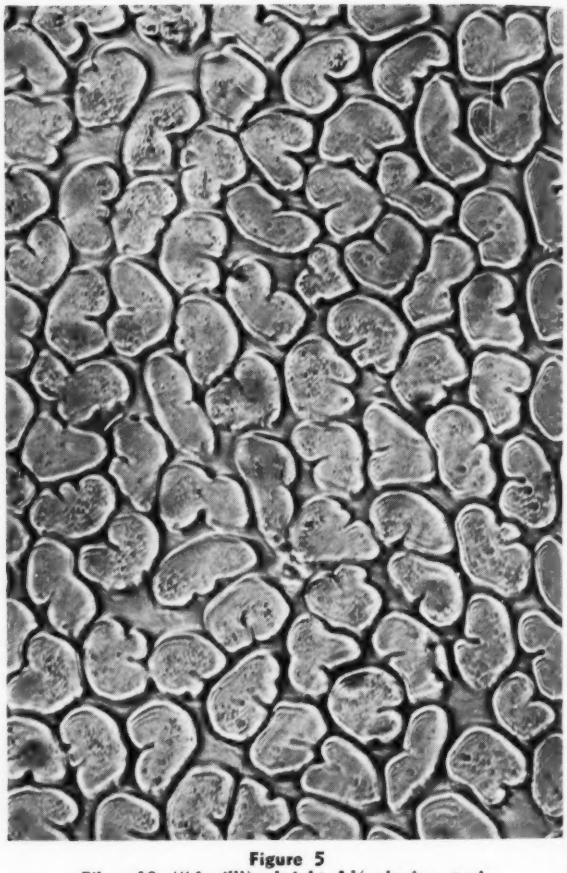


Figure 5
Fiber 40 ("Avril"); bright 1½-denier staple

greenish-brown after three-minute immersion in boiling 1% Identification Stain GDC in 1% acetic acid.[1] *NYLON (6,6) 501*

30c) Fiber has round cross-section, is stained dull red after three-minute immersion in boiling 1% Identification Stain GDC in water, is stained dull red-brown afer three-minute immersion in boiling 1% Identification Stain GDC in 1% acetic acid. Filament fibers may stain to shades approaching those of 30a and 30b. *NYLON (6,6)* (Chemstrand, Du Pont).

31a) Fiber is soluble in cold concentrated hydrochloric acid. *SILK*

31b) Fiber is insoluble in cold concentrated hydrochloric acid, but may gelatinize (regenerated cellulose). [32]

32a) Fiber is soluble in boiling o-dichlorbenzene. *KODEL*

32b) Fiber is insoluble in boiling o-dichlorbenzene. [33] Cellulosic fibers. Subsequent tests must be performed on undyed, unfinished fibers.

33a) Fiber has few-lobed cross-section, is stained pale pinkish-grey after one-minute immersion in boiling 1% Du Pont Identification Stain No. 4. *FORTISAN*

33b) Fiber has round to slightly-lobed cross-section, is stained pale bluish-grey after one-minute immersion in boiling 1% Du Pont Identification Stain No. 4. *FORTISAN 36*

33c) Fiber has round cross-section, is stained dark greenish-blue after one-minute immersion in boiling 1% Du Pont Identification Stain No. 4. *BEMBERG*

33d) Fiber has rounded or polygonal cross-section with slit lumen, is stained medium to dark greenish to slightly greenish-blue after one-minute immersion in boiling 1% Du Pont Identification Stain No. 4. *COTTON, FLAX, HEMP.* (Use microscopic study for further identification).

33e) Fiber has polygonal cross-section with hole lumen, is stained almost black after one-minute immersion in boiling 1% Du Pont Identification Stain No. 4. *JUTE*

33f) Fiber has off-round to crenulate cross-section, no lumen, is stained medium to dark blue; slightly greenish-blue to blue-grey after one-minute immersion in boiling 1% Du Pont Identification Stain No. 4. [34]

34a) Fiber becomes rubbery after five-minute immersion in one-molar cupriethylene diamine. *CORVAL*

34b) Fiber becomes gelatinized after five-minute immersion in one-molar cupriethylene diamine. [35]

34c) Fiber dissolves within five minutes in one-molar cupriethylene diamine. [36]

35a) Fiber has off-round cross-section major:minor diameter ratio 3:2 (see Fig 2), is stained bluish-purple after five-minute immersion in cold mixture of 0.5% CI Acid Red 73 and 0.5% CI Direct

[1]Other lobed nylons recently have been marketed by both Chemstrand ("Cadon," "Cumuloft") and Du Pont ("Antron," "Type 90")

Blue 15 in 1% acetic acid (followed by warm rinse, 15-30 second scour in dilute surfactant at 50°C and rinse). *ZANTREL*

35b) Fiber has oval cross-section, mostly without large lobes, major:minor diameter ratio about 2:1 (see Fig 3), is stained reddish-purple after five-minute immersion in cold mixture of 0.5% CI Acid Red 73 and 0.5% CI Direct Blue 15 in 1% acetic acid, (followed by warm rinse, 15-30 second scour in dilute surfactant at 50°C and rinse). *FIBER 500*

35c) Fiber has off-round cross-section, often egg-shaped, with major:minor diameter ratio 3:2 (see Fig 4), is stained red after five-minute immersion in cold mixture of 0.5% CI Acid Red 73 and 0.5% CI Direct Blue 15 in 1% acetic acid (followed by warm rinse, 15- to 30-second scour in dilute surfactant at 50°C and rinse). *SM-27*

35d) Fiber has very crenulate cross-section, is stained maroon after five-minute immersion in cold mixture of 0.5% CI Acid Red 73 and 0.5% CI Direct Blue 15 in 1% acetic acid (followed by warm rinse, 15- to 30-second scour in dilute surfactant at 50°C and rinse). *TOPEL*

36a) Fiber is staple, has a few-lobed cross-section, with major:minor diameter ratio 4:3 (see Fig 5), is stained light reddish-purple after five-minute immersion in cold mixture of 0.5% CI Acid Red 73 and 0.5% CI Direct Blue 15 in 1% acetic acid (followed by warm rinse, 15- to 30-second scour in dilute surfactant at 50°C and rinse). *FIBER 40 ("AVRIL")*

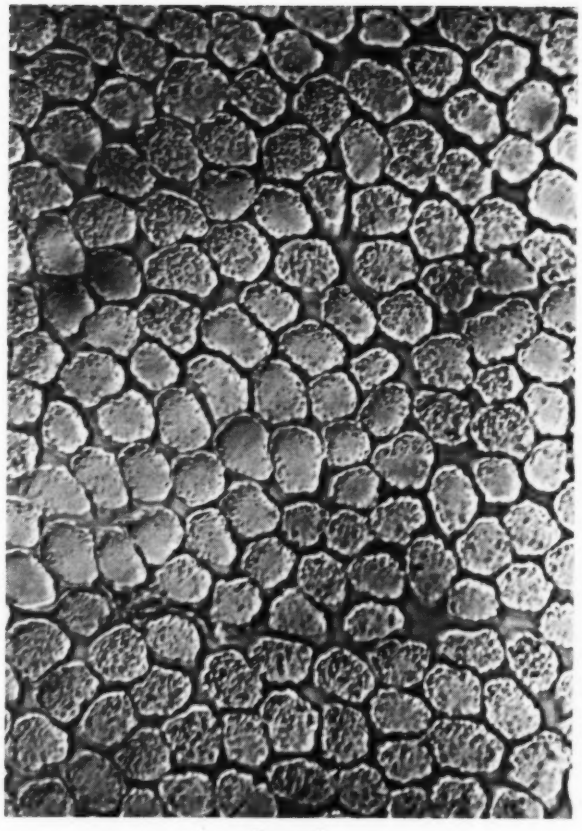
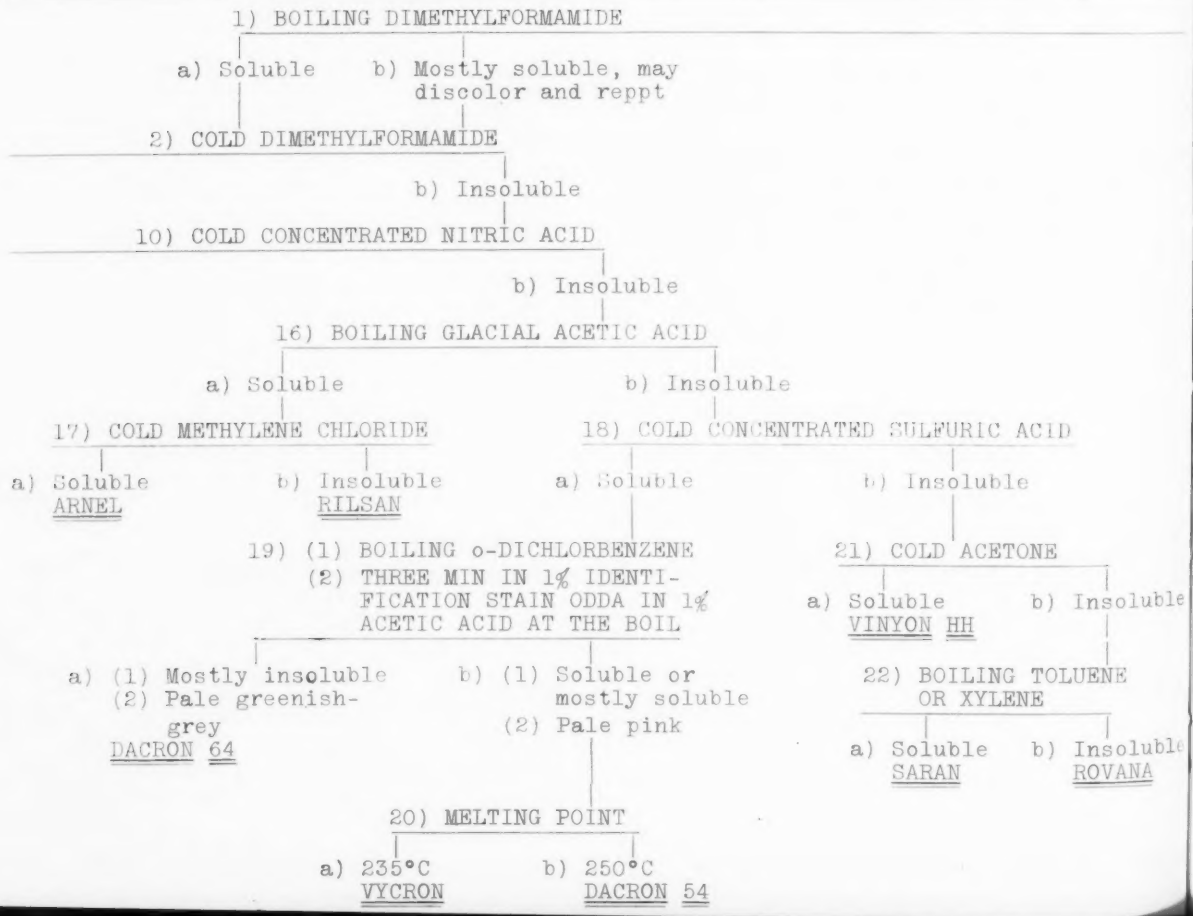


Figure 6
Fortisan 36; bright 1-denier filament

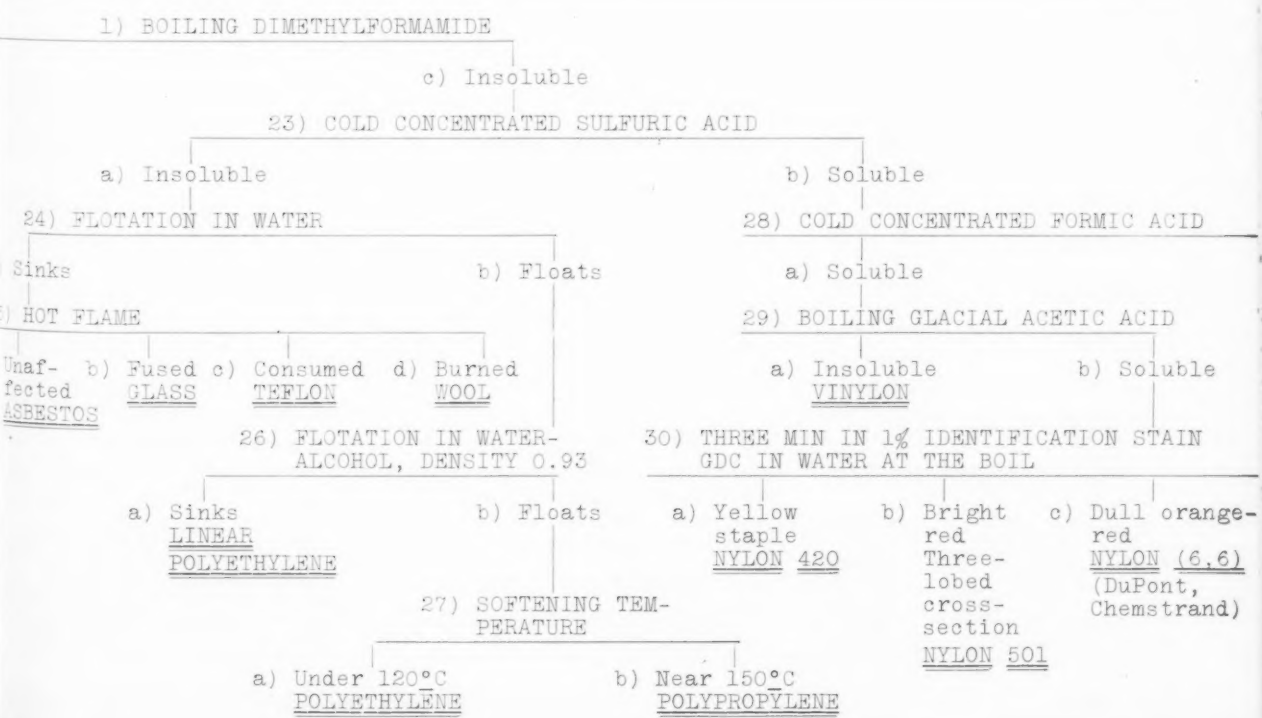
36b) Fiber is staple or filament, has cross-section varying from very crenulate to round, is stained shades of blue, maroon, purple to reddish-purple after five-minute immersion in cold mixture of 0.5% CI Acid Red 73 and 0.5% CI Direct Blue 15 in 1% acetic acid (followed by warm rinse, 15- to 30-second scour in dilute surfactant at 50°C and rinse). Staple blue through maroon, high tenacity filament reddish-purple. *VISCOSE*

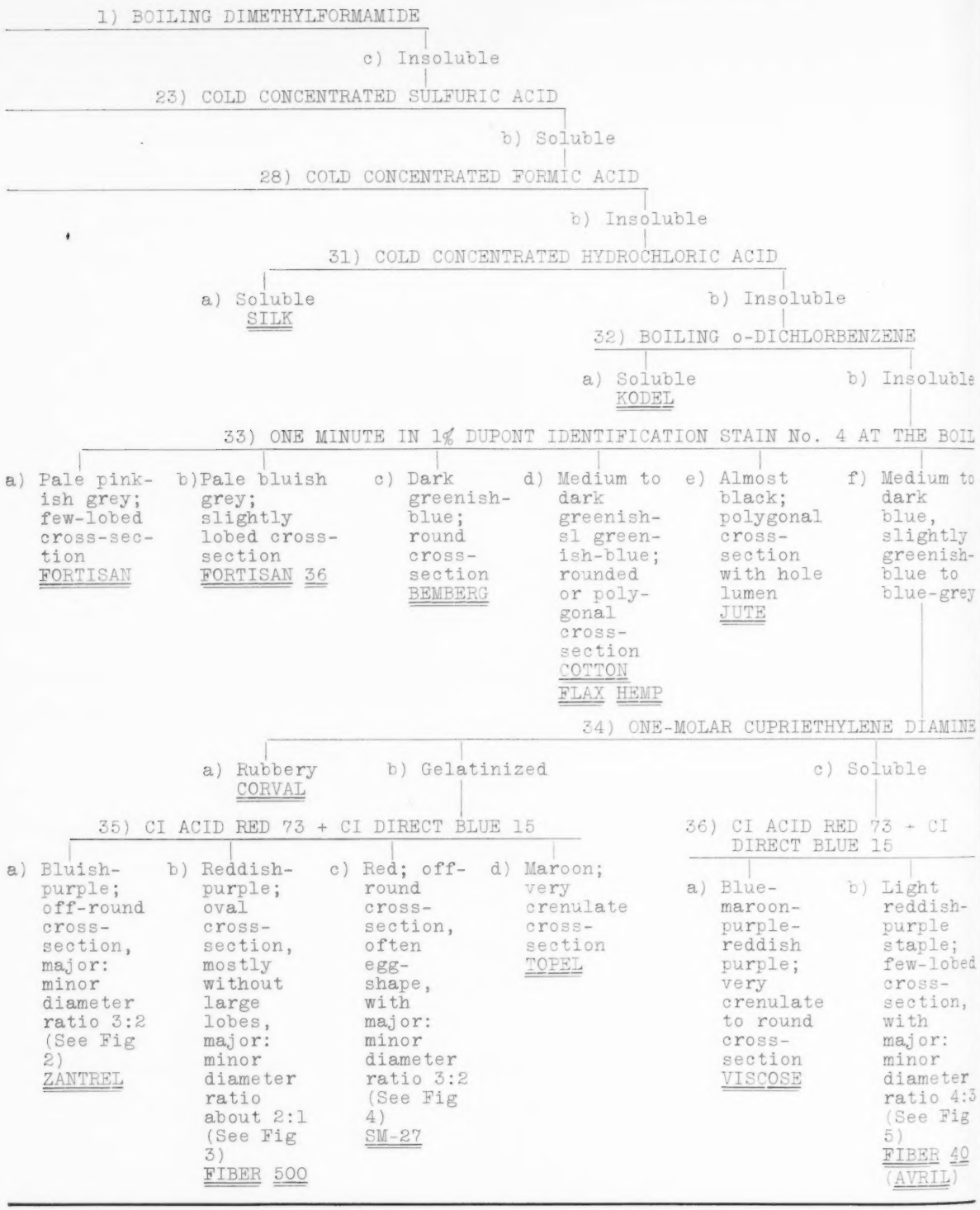
(Schemes for Fiber Identification and Appendices I-VII Follow)

1) BOILING DIMETHYLFORMAMIDE
a) Soluble
b) Mostly soluble, may discolor and reppt
2) COLD DIMETHYLFORMAMIDE
a) Soluble
3) COLD CONCENTRATED SULFURIC ACID
a) Soluble
b) Insoluble
4) COLD CONCENTRATED NITRIC ACID
8) BOILING ACETONE
a) Insoluble (decomposes) VEREL
b) Soluble
a) Insoluble RHOVYL
b) Soluble
5) COLD ACETONE
9) CROSS-SECTION
a) Soluble ACETATE
b) Insoluble
a) C-shaped or similar DYNEL
b) round DYNEL 97
6) BOILING CYCLOHEXANONE OR m-CRESOL
a) Insoluble CRESLAN
b) Soluble
7) COLD DIMETHYLSULFOXIDE OR BOILING 40% w/w POTASSIUM HYDROXIDE
a) Soluble DARVAN
b) Insoluble (See DARVAN X-7 Fig 1)


1) BOILING DIMETHYLFORMAMIDE
a) Soluble
b) Mostly soluble, may discolor and reppt
2) COLD DIMETHYLFORMAMIDE
b) Insoluble
10) COLD CONCENTRATED NITRIC ACID
b) Insoluble
16) BOILING GLACIAL ACETIC ACID
a) Soluble
b) Insoluble
17) COLD METHYLENE CHLORIDE
18) COLD CONCENTRATED SULFURIC ACID
a) Soluble ARNEL
b) Insoluble RILSAN
a) Soluble
b) Insoluble
19) (1) BOILING o-DICHLORBENZENE
(2) THREE MIN IN 1% IDENTIFICATION STAIN ODDA IN 1% ACETIC ACID AT THE BOIL
21) COLD ACETONE
a) Soluble VINYON HH
b) Insoluble
a) (1) Mostly insoluble
(2) Pale greenish-grey DACRON 64
b) (1) Soluble or mostly soluble
(2) Pale pink
22) BOILING TOLUENE OR XYLENE
a) Soluble SARAN
b) Insoluble ROVANA
20) MELTING POINT
a) 235°C VYCRON
b) 250°C DACRON 54

1) BOILING DIMETHYLFORMAMIDE
a) Soluble
b) Mostly soluble, may discolor and reppt
2) COLD DIMETHYLFORMAMIDE
b) Insoluble
10) COLD CONCENTRATED NITRIC ACID
a) Soluble
11) COLD CONCENTRATED HYDROCHLORIC ACID
a) Soluble NYLON (6) (Caprolan; Enka nylon, IRC nylon)
b) Insoluble fil ORLON CANTRECE
c) Insoluble staple or tow
12) (1) 65-60% DIMETHYLFORMAMIDE and 35-40% XYLENE AT 100°C
(2) 98-100% FORMIC ACID at 100°C
a) (1) Insoluble
(2) Does not fuse
b) (1) Soluble
(2) Fuses partly (Orlon 25) or completely (other fibers)
13) (1) FIVE MIN IN 5% NaOH AT 180°C
(2) THREE MIN IN 1% CI DIRECT RED 75 COLD
14) (1) THREE MIN IN 1% IDENTIFICATION STAIN AH AT THE BOIL
(2) CROSS-SECTION
a) (1) Orange
(2) Pink
ZEFRAN
b) (1) No Change
(2) No Change
ACRILAN
a) (1) Yellow
(2) Round or kidney-shaped
ACRILAN 16
b) (1) Very pale yellowish-grey
(2) Dogbone
15) DENIER DETERMINATION
a) Denier 1, 2, 3 or greater ORLON 42
b) Mixed deniers ORLON 39, 39A, 39B
c) 2½ Denier 1½" Staple ORLON 25


1) BOILING DIMETHYLFORMAMIDE
c) Insoluble
23) COLD CONCENTRATED SULFURIC ACID
a) Insoluble
b) Soluble
24) FLOTATION IN WATER
28) COLD CONCENTRATED FORMIC ACID
Sinks
b) Floats
a) Soluble
HOT FLAME
29) BOILING GLACIAL ACETIC ACID
Unaffected ASBESTOS
b) Fused GLASS
c) Consumed TEFLON
d) Burned WOOL
a) Insoluble VINYLON
b) Soluble
26) FLOTATION IN WATER-ALCOHOL, DENSITY 0.93
30) THREE MIN IN 1% IDENTIFICATION STAIN GDC IN WATER AT THE BOIL
a) Sinks LINEAR POLYETHYLENE
b) Floats
a) Yellow staple NYLON 420
b) Bright red Three-lobed cross-section NYLON 501
c) Dull orange-red NYLON (6,6) (DuPont, Chemstrand)
27) SOFTENING TEMPERATURE
a) Under 120°C POLYETHYLENE
b) Near 150°C POLYPROPYLENE


1) BOILING DIMETHYLFORMAMIDE
c) Insoluble
23) COLD CONCENTRATED SULFURIC ACID
b) Soluble
28) COLD CONCENTRATED FORMIC ACID
b) Insoluble
31) COLD CONCENTRATED HYDROCHLORIC ACID
a) Soluble SILK
b) Insoluble
32) BOILING o-DICHLORBENZENE
a) Soluble KODEL
b) Insoluble
33) ONE MINUTE IN 1% DUPONT IDENTIFICATION STAIN No. 4 AT THE BOIL
a) Pale pinkish grey; few-lobed cross-section FORTISAN
b) Pale bluish grey; slightly lobed cross-section FORTISAN 36
c) Dark greenish-blue; round cross-section BEMBERG
d) Medium to dark greenish-sl greenish-blue; rounded or polygonal cross-section COTTON FLAX HEMP
e) Almost black; polygonal cross-section with hole lumen JUTE
f) Medium to dark blue, slightly greenish-blue to blue-grey
34) ONE-MOLAR CUPRIETHYLENE DIAMINE
a) Rubbery CORVAL
b) Gelatinized
c) Soluble
35) CI ACID RED 73 + CI DIRECT BLUE 15
a) Bluish-purple; off-round cross-section, major: minor diameter ratio 3:2 (See Fig 2) ZANTREL
b) Reddish-purple; oval cross-section, mostly without large lobes, major: minor diameter ratio about 2:1 (See Fig 3) FIBER 500
c) Red; off-round cross-section, often egg-shape, with major: minor diameter ratio 3:2 (See Fig 4) SM-27
d) Maroon; very crenulate cross-section TOPEL
36) CI ACID RED 73 + CI DIRECT BLUE 15
a) Blue-maroon-purple-reddish purple; very crenulate to round cross-section VISCOSE
b) Light reddish-purple staple; few-lobed cross-section, with major: minor diameter ratio 4:3 (See Fig 5) FIBER 40 (AVRIL)

ACKNOWLEDGMENT

Appreciation is expressed to the Institute students who performed most of the fiber-staining work referred to in the report. Suggestions from and encouragement by fellow staff members was also most helpful. In addition, thanks are due to the companies which so willingly supplied fiber samples on request.

LITERATURE CITED

(1) Bumiller, M L, "Schnellmethoden zur Identifizierung von Textilfasern", *Reyon Zellwolle andere Chemiefasern 34*, No. 9, 612-7 (1956).

(2) Skinkle, J H, "Textile Testing", p 209, Chemical Publishing Co, Inc, New York (1949).

(3) Longitudinal and cross-section photomicrographs of natural fibers and many man-made fibers may be found in the *AATCC Technical Manual* for 1959. The July 21, 1960 issue of *America's Textile Reporter* contains a special section on man-made fibers with a large collection of cross-sections.

APPENDIX I

Comparative solubilities of acetate (cellulose diacetate) and Arnel (cellulose triacetate)

Fiber	*Acetone*	*Methylene chloride*	*Conc HCl*	*Glacial acetic acid*	*Dimethyl-formamide*	*Ethyl acetate*
Acetate	S	I	S cold	S warm	S cold	S
Arnel	S (partly)	S	S hot	S at boil	S hot	I

Legend: S—Soluble, I—Insoluble
Note: With Identification Stain A, acetate staple and filament fiber dye dull yellowish-green, while Arnel dyes a slightly dull orangey yellow shade.

APPENDIX II

Comparative solubilities of the acrylic fibers

Fiber	*Acetone* cold	*Acetone* boil	*Dimethyl-formamide* cold	*Dimethyl-formamide* boil	*Cyclo-hexanone, boil*	*Glacial acetic, boil*	*m-Cresol, boil*	*Conc nitric, boil*	*Dimethyl-formamide -xylene (62:38 vol) 100°C*	*Dimethyl sulfoxide, cold**	*Stick temp degrees*
Acrilan	I	I	I	S	I	I	I	S	I	D	473F 245C
Acrilan 16	I	I	I	S	I	I	I may fuse slightly	S	S	D-S	450F** 232C**
Creslan	I	I	S slow	S	I	I	I	S	S	S	430F 220C
Darvan	I	D	S	S	S	I	S	S	S	S	350F 180C
Darvan X-7	I	D	S	S	S	I	S	S	S	D	?
Dynel	S	S	S	S	S warm	fuses	gels	fuses	S	S	250F 120C
Dynel 97	S partly	S	S	S	S	fuses slow	gels	fuses slow	S slower	S	?
Orlon 42, 39, 25	I	I	I	S	I	I	I	S	S	S	455F 235C
Orlon Cantrece	I	I	I	S	I	I	I	S	I	S	?
Verel (all forms)	I	S	S	S	S	swells	D	D	S	S	300F 150C
Zefran	I	I	I	S	I	I	I	S	I	D	490F 255C

Legend: I—Insoluble, S—Soluble, D—Decomposes, Insoluble. *Test 10 minutes. Acrilan, Zefran soluble in 30 minutes. Heavy denier fibers (over 5 denier) may be very slowly soluble.
**Approx temp.

APPENDIX III

Solubility behavior and color reactions of various cellulosic fibers

Fiber	*One-molar cupriethylene diamine*	*Indent Stain A**	*Indent Stain No. 4**	*CI Acid Red 73* & CI Direct Blue 15*
Cotton	mostly sol	blue-grey	dull bluish-green	purplish blue
Rayon (regular)	soluble	pink to bluish-pink	blue to greenish-blue	blue
Rayon (carpet)	soluble	variable, darker than regular rayon	dark blue	maroon
Rayon (filament)	soluble	bluish-pink	bright blue	blue to purplish-blue
Bemberg	soluble	bluish-pink	dark, dull blue-green	dark blue
Fortisan	gelatinizes	bluish-pink	pale grey	pale pink
Fortisan 36	gelatinizes	pale greenish-grey	bluish-grey	pink (sl bluish)
Corval	becomes rubbery	dark reddish-blue	dull, slightly reddish-blue	maroon, red after soaping
Topel	gelatinizes	medium violet	greenish-blue	maroon, blue after soaping
Fiber 40	soluble	slightly violet grey	slightly reddish-blue	reddish-purple
Fiber 500	gelatinizes	slightly violet grey	slightly reddish-blue	reddish-purple
SM-27	gelatinizes	blue-grey	light blue	light purplish-red
Zantrel	gelatinizes	bluish-pink	dull blue-green	purplish-blue

*See Table III

APPENDIX IV
Comparative solubilities and color reactions of nylon

Fiber	Conc HCl, cold	Dimethyl-formamide, boil	Melting point, C	Indent stain A*	Indent stain ODDA*	Calco Stain No. 2*	Indent stain GDC* No acid	Indent stain GDC* With acid
Nylon (6,6) (regular)	S	I	250	greenish-black	red-dark red	red-brown	dull red-orange	dull red-brown
Type 420	S	I	250	green	pinkish-red	brownish-pink	pale yellowish-orange	light red-orange
Type 501	S	I	250	black	dark red	dark red-brown	red	dull dark brown
Filament	S	I	250	greenish-black	red	red-brown	dull red-orange	dull red-brown
Nylon (6)	S	S	215	—	—	—	—	—
Caprolan fil	—	—	—	black	dark-very dark red	red-brown	bright bluish-red	dull purple
Enka staple	—	—	—	black	dark-very dark red	reddish-brown	dull brownish-red	dark greenish-brown
IRC staple	—	—	—	black	dark-very dark red	red-brown	dull brownish-red	dark greenish-brown
Nylon (11) (Rilsan)	I	S	190	yellowish-green	pink	tan	yellow	orange-yellow

*See Table III

APPENDIX V
Color reactions of the acrylic fibers

Fiber	5% NaOH five min @ 180 F	Conc sulfuric, cold	40% w/w Aq KOH, heat to boil	Indent stain ODDA*	Indent stain A*	CI Acid Blue 25	CI Direct Red 75
Acrilan	NC**	S	yellow-orange	dull bluish-red	dark dull greenish-blue	med blue	sl stain
Acrilan 16	NC	S	yellow-orange	light greenish-tan	brownish-orange	sl stained	NC
Creslan	NC	S	yellow	red	dark bright blue	med blue	NC
Darvan	NC	S	S	light violet	dull pink	NC	NC
Darvan X-7	NC	S	decomposes-brownish	red-violet	dull purplish-grey	light blue	NC
Dynel	NC	gels-yellow	grey-black	dull bluish-green	dull pinkish-brown	sl stained	NC
Dynel 97	NC	gels-yellow	grey-black (slow)	light bluish-green	pinkish-brown	sl stained	NC
Orlon 42, 39, 25	NC	S	yellow-orange	light pinkish-tan	pinkish-orange	NC	NC
Orlon Cantrece	NC	decomposes—greyish	yellow-orange	light pinkish-tan	pinkish-orange	NC	NC
Verel (all forms)	NC	S-pale yellow	purplish-black (rapid)	green	dark red-brown	NC	NC
Zefran	Orange	S-strong orange	yellow-orange	brownish-red	greenish-black	med blue	strong pink

*See Table III
**NC—No color change; S—soluble

APPENDIX VI
Comparative solubilities, melting points and color reactions of polyester fibers

Fiber	Conc HNO_3, cold	m-Cresol, boil	Nitro-benzene, boil	40% w/w aqueous KOH, boil	Dimethyl-formamide, boil	o-Dichloro-benzene, boil	Melting point*	Indent stain ODDA**	Indent stain A**
Dacron 54	I	S	S	S	S may be partly S	mostly S	250 C 480 F	pink	pinkish-tan
Dacron 64	I	S	S	S	S	slightly S	250 C 480 F	greenish-gray	reddish-tan
Kodel	I	S	S	D slowly	I	S	295 C 560 F	pink	pinkish-tan
Vycron	I	S	S	S	S	S	235 C 455 F	pink	pinkish-tan

Legend: I—Insoluble, S—Soluble, D—Decomposes, Insoluble
*Trade literature values
**See Table III

APPENDIX VII

Annotated bibliography of some recent papers on fiber identification

(1) Bobeth, W, and Muller, U, "The Identification of Inorganic Fibers." *Fasterforsch u Textiltech 7*, 497-504 (1956), in German, through *Chem Abst 51*, 4717h (1957).

" . . . With the aid of microchem methods, especially with H_2SO_4 and HF, a quick and comprehensive identification is achieved by which a scheme for the detn of all inorg fibers may be set up."

(2) deSmet, W, and Gomes, J, "Rapid Identification of Regenerated and Synthetic Fibers." *Revue Textilis 13*, No. 3, 15-22 (Mar, 1957), in Dutch, 42 references.

An identification scheme which depends largely on solubility is presented. Emphasis is on methods for distinguishing cellulose diacetate and triacetate, nylon 6 and nylon 6,6, viscose and cupra rayons, poly (vinyl chloride) fibers, and regenerated protein fibers.

(3) Fischer, R, and Kartnig, T, "The Identification of Synthetic Fibers by an Embedding Method with the Kofler Hot Stage." *Z ges Textil-Ind 60*, 830-832 (1958), in German, through *Chem Abst 53*, 5683e (1959).

" . . . The fibers are embedded in a liquid with an η somewhat higher than that of the fibers to be tested. The fibers are then examd in a polarizing microscope fitted with a hot stage, and the temp of the slide is raised slowly until the Becke line disappears. . . . This temp is found to be characteristic not only of the type of fiber but in many cases of the manufg source as well. A list of suitable liquids for embedding, and the results obtained with 36 different fibers are given."

(4) Frieser, E, "Poly (Vinyl Chloride) Fibers, Their Analysis, Composition and Quantitative Determination in Mixtures with Other Fibers." *Textil-Rundschau 14*, 1-16 (1959), in German, through *Chem Abst 53*, 9677f (1959).

"Trade names and sources of 19 poly(vinyl chloride) fibers are compared with those of polyesters, -amides, and -acrylonitriles." Qualitative tests and quantitative methods are described and augmented with tables.

(5) "Identification of Metallic Yarns," *Man-Made Textiles 33*, 70-71 (Mar, 1957).

A burning test, a stretch test, and immersion tests in water, isopropyl acetate, and acetone are used to distinguish cellulose acetate, cellulose acetate-butyrate, cellophane, and foil and metallized Mylar aluminum-laminated yarns.

(6) Kato, K, "Procion Dye Staining for Differentiation of Skin and Core of Viscose Rayon Fibers." *Textile Research J 29*, 661-664 (1959).

Cellulosic fiber cross-sections are stained by adding aqueous Procion Black HGS, containing urea and soda ash, to slide preparations, heating and rinsing. Skin-type regenerated cellulose is selectively dyed black.

(7) Koch, P A, "Detecting and Distinguishing Among the Various Chemical Fibers." *Textil-Rundschau 14*, No. 8, 438-445 (Aug, 1959).

Includes a miscroscopic-chemical scheme for fiber identification, sketches of 50 fiber cross-sections, a table showing "Type reactions" for fibers, and a new sequential solubility scheme for use in fiber identification. Emphasis is, naturally, on European regenerated and synthetic fibers.

(8) Koch, P A, and Stratmann, M, "Identification of Fibers by Means of Chemical Reactions." *Textilber 39*, 1141-1145 (1958), in German.

A solubility table shows behavior of 26 fibers (or groups of closely related fibers) in 24 solvents, cold and hot. An analytical scheme based on the table is also given. Zefran, Creslan, Verel and Darvan are among the fibers listed.

(9) Praeger, S S, "Comparative Solubilities of Natural and Man-Made Fibers," *Am Dyestuff Reptr 34*, 281-282 (Apr 25, 1955).

Quantitative solubility data for 16 fibers in two concentrations of $ZnCl_2$ as well as in several other solvents are presented.

(10) Smith, S G, "Identification of Unknown Synthetic Fibers. Part II. Applications of Polarized Light Microscopy," *ibid 48*, 35-39 (Mar 23, 1959).

"This paper is partly the result of a study of the polarized light microscopy of man-made synthetic fibers as applied to their identification. It describes a working method, and it attempts to tie useful data into an analytical scheme previously published in the March 10, 1958 issue of *American Dyestuff Reporter* . . ."

(11) "Some Tests for Distinguishing Between Polyamide and Polyester Fibers," *Ciba Rev 127*, 30-35 (July 1958).

Several simple chemical tests are described, along with solubility tests and a melting point method in which the fibers are boiled in benzyl acetate (B P 213.5°C).

(12) Stratmann, M, "The Behavior of Synthetic Fibers to Various Zinc Chloro-iodide Solutions." *Z ges Textil-Ind 60*, 450-456 (1958), in German.

The "Behrens/Merck," "Lange," and "Herzberg" zinc chloro-iodide solutions are found to produce characteristic color changes and swelling behavior with the acrylic, "modacrylic," and "nytril" fibers.

Abstracts

New Finishes in Textiles

Whewell, C S, *Textile Recorder 77*, 60-1, June, 1960

Research in the yarn and fabric finishing industry is aimed at the same time at giving man-made fibers the more desirable properties of the natural fibers and endowing natural fibers with some of the properties of certain man-made fibers.

The production of "wash-and-wear" fabrics is now the concern of almost all textile manufacturers. "Wash-and-wear" cellulosic fabrics are based on treatments involving the use of resins or cross-linking agents. The general effect is to alter the moisture absorption characteristics of the fiber, to improve resistance to creasing, and to make the fabric dimensionally stable. The resins most commonly used are those based on urea- or melamine-formaldehyde. Fabrics are padded with a mixture of a resin precondensate and a catalyst, then dried, and finally baked.

Two theories have been put forward to explain the effectiveness of this treatment. In one, the penetration of the resin polymers into the amorphous regions of the cellulose is considered to be the important feature of the reaction, while in the other, cross-linking between the cellulose chains is stressed.

It is unfortunate that high wet and dry crease resistance seem to be difficult to obtain at the same time. Many finishes tend to yield good dry crease resistance with only moderate wet crease resistance. If high wet crease resistance is required, treatment with dichloropropanol under alkaline conditions is recommended, or alternatively, treatment with formaldehyde in presence of concentrated solutions of sulfuric acid.

The production of "wash-and-wear" wool fabrics presents many more problems and is still in its infancy. The commercial production of such fabrics has developed from the work on shrinkproofing wool and the production of permanent creases and pleats in wool, for clearly, "wash-and-wear" wool fabrics will require a finishing treatment which includes relaxation (to minimum relaxation shrinkage), an antifelting treatment, and a stabilizing treatment, ie, setting the cloth in the flat, relaxed state.

Many shrinkproofing treatments are available, eg, the permanganate-hypochlorite treatment, the permono-sulfuric acid-sodium bisulfite process, the many controlled chlorination processes (eg, the Melafix process), the peracetic acid-hypochlorite process, the Tootal alkali process, and a new process involving treatment with permanganate in conc salt solutions followed by cleaning with bisulfite.

Sodium bisulfite is recommended for the non-iron finish on wool. The fabric is padded with the reagent and steamed for three to five minutes at 60 psi.

Various fireproofing methods are discussed, particularly one containing two phosphorous compounds, APO and THPC. Mothproofing is also discussed briefly.

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Hydrogen Peroxide Bleaching of Cotton

Ramadan, A S, *J Textile Inst 51*, T215-26, June, 1960

The investigation of peroxide bleaching of cotton, reported by the author, had the following objectives:

1) To study the effect of time, temperature, pH, nature and concentration of various additions on the rate of bleaching, on the consumption of H_2O_2, and on the quality of the resultant bleached fabric.

2) To investigate the effect of various metals and alloys on the stability of a H_2O_2 bleaching bath, in connection with the question of their suitability for the construction of bleaching equipment.

3) To compare peroxide bleaching

with other methods of bleaching from the standpoint of the quality of the white and the extent of chemical degradation of the cellulose.

The cotton fabric used in the trials was desized, scoured and mercerized prior to bleaching.

Starting with a normal bleaching bath containing H_2O_2 and sodium silicate, the author studied the effect of varying the silicate content and of adding soda ash and caustic soda on the rate of bleaching, decomposition of the peroxide, etc. The results are tabulated.

It is well known that a more stable bleach bath is frequently obtained when the water used contains calcium and magnesium hardness. The author added varying amounts of magnesium sulfate to a H_2O_2 bleach bath, and found that with increasing amounts the rate of decomposition of H_2O_2 fell steadily. This suggested that magnesium silicate (formed in the bath) is an excellent stabilizing agent.

Addition of phosphates to a bleach bath stabilized by magnesium silicate proved to have no advantage. Also, silicates of calcium, barium, zinc and aluminum were tried, but none was as effective as magnesium silicate.

The author also studied the catalytic action of various metals on the peroxide bath by suspending strips of the metals in peroxide solution stabilized by silicate. After two hours at 80°C the loss of peroxide was determined. Of all the metals tried, aluminum showed the lowest decomposition rate, being superior even to stainless steel.

The author concludes that, by the careful control of conditions, a satisfactory bleach can be obtained with a very low consumption of H_2O_2, as compared with normal practice. The bleach bath can be stabilized by means of suspensions of magnesium silicate or by means of magnesium complexes with ethylenediaminetetraacetic acid, or with sulfated fatty alcohols. Such a bath can be used continuously, he states, only small additions of H_2O_2 and sodium silicate being necessary to maintain efficient bleaching. In order to avoid contamination of the bleaching bath, preliminary desizing and scouring are recommended.

Comparative trials indicated that H_2O_2 bleaching, under the conditions specified, offers definite advantages over sodium chlorite bleaching from the standpoint of permanence of the whiteness, wettability, and freedom from chemical degradation. There are also indications that aluminum should prove useful in the construction of peroxide bleaching equipment.

Twelve references to the literature are cited.

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Fibers Based on Polyvinyl Chloride

Hopff, H and Greber, G, *Ciba Rev* #137, 9-16, April, 1960

Fibers from polyvinyl chloride (PVC) were first produced in 1931, and with improved properties (by chlorination), under the name "PeCe", in 1934. A further advance was made by the firm of Rhodiaceta, which developed the well-known PVC fibers Rhovyl, Fibrovyl and Thermovyl.

PVC fibers have commercial importance due to their excellent resistance to many chemicals, including aqua regia, caustic soda, and hydrofluoric and nitric acids. The PeCe fiber is practically rotproof, since it does not swell in water and is unaffected by bacteria and insects. It has found wide use for netting in the fishing industry.

Other advantages of PVC fibers are a wet strength even higher than the dry strength, and nonflammability, due to their high chlorine content. They have found uses in protective clothing for chemical workers, in cordage, and in acid-proof filter cloths.

The production of PVC from the the monomer, vinyl chloride, and the spinning of the fibers are described in detail.

Dyeing of PVC fiber at first presented considerable difficulty because of insufficient swelling of the material in water. Serviceable full shades of good fastness are obtained, however, with the aid of suitable carriers or swelling agents such as acetone, alcohol, and ethyl vinyl urethan. Dyeing proceeds at 50-70°C for 65-70 minutes. The drying temperature should not exceed 70°C in order to avoid shrinkage. Products mainly applicable are disperse dyes, which give dyeings of good wetfastness though of only moderate fastness to light. A high degree of lightfastness is obtainable by solution-dyeing with pigments.

Low heat resistance limits the uses of PVC as a textile fiber. Contraction of the fiber occurs at temperatures above 85°C. To obtain improved heat resistance, various copolymers of vinyl chloride and other products (eg, vinylidene chloride, vinyl acetate and acrylonitrile) are in commercial production. The fibers Saran and Dynel belong in this category.

Use of Reactive Dyes for Dyeing Wool and Wool Unions

Hadfield, H R and Lemin, D R, *Dyer* 123, 872-3, June 3, 1960

The effect of the dyebath pH on the hydrolysis, rate of reaction, and rate of exhaustion of Procion dyes on wool is discussed by the authors, and information is presented on the effect of fixation on fastness properties. The relation of these properties to the practical dyeing behavior of Procion dyes on wool is shown, and optimum dyebath conditions are suggested.

Although H-type Procion dyes are less skittery-dyeing than cold-dyeing Procions, they are still not sufficiently good to allow their use for most purposes in wool dyeing. Fortunately it has been found that, when wool is dyed with both cold-dyeing and H-type Procions in the presence of a cationic and a nonionic agent, good coverage of skittery wools is achieved. The same result is observed in the presence of cationic agents only, but in the absence of a nonionic agent precipitation of a dye-agent complex results. In practice, the use of agents of this type can cause troublesome foaming of dye liquors, and to prevent this the use of a silicone antifoaming agent is advised.

Level results can be obtained in full shades with Procion dyes on loose wool, slubbing, yarn, and knitted piece-goods, but these dyes are not very well suited for dyeing pale shades or tertiary shades. The very high wetfastness associated with the reactive dye when combined with wool cannot, in practice, be realized because of the presence of absorbed, unreacted, hydrolyzed dye. For this reason, in most shades on 100 percent wool dyed by conventional dyeing techniques, results of equal or better fastness can be obtained with acid milling dyes which are easier to apply. It is only for certain shades, eg, full greenish yellows or reds, that the high lightfastness of Procion dyes applied to wool makes these products attractive.

A valuable property of the cold-dyeing Procion dyes is that they dye cotton or rayon from a cold alkaline dyebath and leave wool virtually unstained. Thus, a new technique is available for dyeing unions of wool and cellulosic fibers. The cellulose is dyed first, either by a conventional method or by the pad-batch technique, and is soaped-off in a neutral bath, to remove the unreacted Procion dye. The wool is then dyed with selected acid milling dyes of good affinity.

COTTON FABRIC WITH WET WRINKLE RECOVERY PRODUCED WITH FORMALDEHYDE WITHOUT EXCESSIVE STRENGTH LOSS

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The crosslinking of cotton fabric with formaldehyde while in a water swollen state was studied with the object of producing by a practical method a fabric having good wet wrinkle recovery without excessive degradation of fabric strength. This was accomplished in a pilot plant by padding the fabric through an aqueous solution of formaldehyde and hydrochloric acid and allowing to react in the wet state at room temperature by 1) remaining on the roll, 2) plaiting into a box (referred to as a J box process). After the required length of time (five to 20 minutes) the fabrics were given an alkaline process wash, and dried. Bleached mercerized fabric was found to be more suitable than bleached fabric in the process because a given degree of wet wrinkle recovery was acquired at a faster rate and a lower level of combined formaldehyde. Also the final tear strength, and breaking strength, which were much greater with the mercerized fabric, were well within a practical range Fabrics treated by this process had good wet wrinkle recovery only, and would be of practical use only when line dried.

Preliminary experiments indicated that cotton fabrics which were reacted to a low degree with formaldehyde and then topped with a small amount of crease-proofing resin (in the range of 2.5%) such as a triazone, had as much initial wet and dry wrinkle recovery as was obtained with about 5% of the same resin on the original cotton fabrics.

INTRODUCTION

CONSIDERABLE research is being done at the Southern Regional Research Laboratory in the filed of "wash-and-wear" cotton goods. One phase of this work is aimed at crosslinking cotton cellulose while in a partially swollen state to produce wrinkle-resistant fabrics with good strength characteristics. Loss in both tear and tensile strength is one weakness of the currently used "wash-and-wear" finishing agents.

The physical properties of cotton fabric are dependent to a large measure upon the extent of swelling or degree of openness of the fiber at the time of crosslinking. For example, when crosslinking occurs with the fibers in a collapsed condition, the fabric will have both dry and wet wrinkle recovery. This is the situation that occurs with the finishing agents in general use today. Crosslinking with the fibers in a highly swollen state by the usual one-step process, as with glyceroldichlorohydrin in the presence of alkali solution, generally results in wet, but little or no dry wrinkle recovery. Wet and dry wrinkle recovery is needed to produce fabrics that will dry wrinkle-free and also be muss resistant. With wet and dry wrinkle recovery, fabrics can be tumble-dried without excessive wrinkling. Wet recovery alone will enable goods to line-dry wrinkle free. This is perhaps all that is needed for many household goods, especially in homes where driers are not available.

The purpose of this paper is to report a convenient method of crosslinking cotton fabric with formaldehyde while swollen in water. Thus a method of imparting wet wrinkle recovery to cotton fabric is reported. Formaldehyde is cheap, and very reactive; considerable knowledge of the reaction of it with cellulose is already available. A number of authors have recognized that only a small amount of formaldehyde is needed to produce substantial physical changes in cotton fabrics. Gruntfest and Gagliardi (*6*) showed that 2% of bound formaldehyde, HCHO, in cotton fabric produced as much wrinkle recovery as 10% in rayon. The Philadelphia Section, AATCC (*11*) demonstrated that HCHO was far more efficient on cotton than a wide variety of other finishing agents, but it also reduced the strength much more than other materials. Goldthwait (*5*) produced considerable change in dyeing characteristics with as little as 0.4% HCHO. Formaldehyde has several advantages over N-methylol type compounds which are so widely used today. The formaldehyde finishes are quite resistant to hydrolysis and are not affected by chlorine bleach.

Formaldehyde has received extensive study over the past fifty years since Eschalier (*4*) first found that it improved the wet strength of regenerated cellulose. Very little work was done with cotton until after 1944. Much effort has been made to determine the structure of the reaction product of cellulose and formaldehyde. Wagner and Pacsu (*14*) showed that formaldehyde crosslinked cellulose mainly by methylene bridges, and also showed that formaldehyde reacted preferentially with the secondary hydroxyl groups. Steele (*12*) through infrared spectral studies added additional evidence that the crosslinks are mainly methylene bridges. Woo, Dusenbury, and Dillon (*15*) did an extensive study on the reaction rate of HCHO with cotton, rayon, and Fortisan, and also on the mechanical behavior of these fibers, yarns, and fabrics when reacted with HCHO (*16*). Although these authors were able to finish rayon with essentially no strength loss, they concluded that the HCHO finish under optimum conditions is highly detrimental to cotton and Fortisan. Hurwitz and Conlon (*8*) compared the strength losses obtained by finishing cotton with dimethylolethyleneurea and with HCHO. To get equivalent degrees of wrinkle resistance the strength losses were much greater with formaldehyde. Although it is often said the excessive strength loss obtained with formaldehyde is due to the short crosslinks, Hurwitz and Conlon expressed doubt in this idea. Work of Woo and coworkers (*15*) has shown that loss in breaking strength occurs mainly as a result of acid hydrolytic degradation that accompanies the formaldehyde treatment. Goldthwait (*5*) found that the amount of water in the reacting system at the time of methylenation influenced the loss of strength. He was able to produce yarn that had essentially complete dye resistance without reducing the strength of the yarn. In this case, yarn was immersed for four hours in a hot solution of acetic acid and anhydride containing paraformaldehyde and a small amount of sodium chloride as catalyst. The outstanding feature of his work, as related to the present study, is that he demonstrated that cotton can be crosslinked with formaldehyde without materially reducing strength. This fact has

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encouraged the present investigations.

In the current work, aqueous systems have been used in order to keep the process commercially feasible, should practical results be obtained. An aqueous system was used by Morton (*10*) in 1936 to finish viscose rayon. With 5% sulfuric acid as catalyst, he obtained a fabric that showed high swelling in water and an increased affinity for direct dyes, but no increase in wrinkle recovery. He obviously examined the fabric for only dry wrinkle recovery. In a similar procedure Guthrie observed wet wrinkle recovery with cotton fabric (*7*). With today's knowledge of the principle of imparting wet wrinkle recovery, it seemed that this or some modification of the method would be expected to impart wet wrinkle recovery.

MATERIALS AND METHODS

Cotton print cloths were used in this sturdy. One referred to as bleached print cloth was 80 × 80 desized, scoured, and bleached cloth weighing approximately 3.1 oz/sq yd. This fabric had an Elmendorf tear strength of 1265 gms, and a strip breaking strength of 45 lbs. The other referred to as mercerized print cloth was the same fabric as above, except it had been mercerized also. Tension was applied only in the warp direction during mercerization. The mercerized fabric had 1400 gms tear strength and 44 lbs breaking strength.

The formaldehyde was a commercial grade 37% formalin solution containing 12% methanol. Aqueous HCl solution containing 37% HCl was used. The amounts of hydrochloric acid used and reported in the experiments are actual weight percentages of acid in the treating solution.

Fabric properties were determined by ASTM procedures: breaking strength, strip method (*2a*); dry wrinkle resistance, Monsanto method (*2b*); tear resistance, Elmendorf method (*2c*); and flex abrasion using the Stoll Abrader (*2d*). The wet wrinkle resistance was done according to Lawrence and Phillips (*9*).

Formaldehyde determinations were made by hydrolyzing the methylenated cotton with sulfuric acid and subsequent colorimetric estimation of the formaldehyde in the distillate with phenylhydrazine (*3*).

EXPERIMENTAL

Two general methods were used for reacting formaldehyde with cotton. One, called the "soaking" technique, consisted of immersing the fabric in the reaction solution for predetermined times after first padding with two dips and two nips. The other procedure, called the J-box technique, consisted of padding the fabric through the formaldehyde solution and either batching on a shell or plating out into a box for predetermined times. The conventional drying and curing steps have been omitted. In all cases the wet fabrics were rinsed briefly in tap water at about 28°C, then in warm water (40-60°C) for about 30 minutes. In some cases the fabrics were placed in dilute sodium carbonate solution to neutralize the hydrochloric acid, then rinsed briefly to remove the salt. In either case, the rinsing treatment is referred to below as a process wash.

HYDROCHLORIC ACID CATALYST——A wide variety of acid catalysts have been reported to catalyze the reaction of formaldehyde with cellulose. In general, the catalytic action is related to the strength of the acid. One exception is boric acid. Hydrochloric acid was selected for use in this study because considerable information is already available on the use of latent acid catalysts, such as aluminum chloride and ammonium chloride, which produce hydrocholric acid (HCl), and these are excellent catalysts for reacting HCHO with cellulose.

TABLE I

Influence of HCl concentration upon the reaction of HCHO with cotton print cloth immersed in solution

Solution Concentration HCl (%)	Solution Concentration HCHO (%)	Reaction time (minutes)	Appearance of drip dry fabric (AATCC rating)	Wet wrinkle recovery (w+f) (degrees)	Combined HCHO(%)
19.5	7.4	10	5	261	0.48
19.5	7.4	40	5	290	0.58
12.2	7.6	10	3	196	0.16
12.2	7.6	40	4	202	0.26
4.2	7.9	10	2	162	0.01
4.2	7.9	40	2	168	0.02

In order to determine an effective concentration of hydrochloric acid, print cloth was immersed in an aqueous solution containing 7.4% HCHO and various amounts of the acid. Aliquots of the fabric were removed from the solution at 10 and 40 minutes. The solution temperature was about 28°C. The treated fabrics were machine washed and placed on a line to drip dry. The drip-dried samples were rated according to the AATCC (*1*) for "wash-and-wear" qualities. It can be seen in Table I that 19.5% hydrochloric acid produced fabrics with a very good "wash-and-wear" rating (*1*), while the lower concentrations were less effective. The ratings were made after a single machine wash and drip dry rather than five as recommended by the AATCC Committee (*1*). The wet wrinkle recovery was also much better for the fabric reacted in the 19.5% acid solution. The 19.5% acid solution was prepared by adding 500 ml of concentrated hydrochloric acid (37% HCl) to a solution consisting of 200 ml of commercial formalin and 300 ml of water.

REACTION OF PRINT CLOTH AND MODIFIED PRINT CLOTH WITH HCHO BY SOAKING——A solution containing 19.5% hydrochloric acid (weight %) and 7.4% HCHO was used in this and subsequent experiments except where specified. Th
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TABLE II

Physical properties of print cloth and modified print cloth treated with HCHO by soaking

	Reaction time (minutes)	Wet wrinkle recovery (w + f) (degrees)	Elmendorf tear (warp (gms)	Breaking Strength (warp) (lbs)
Print cloth	0	194	1265	45
	3	191	995	35
	10	236	765	27
	30	281	555	24
Carbamoylethylated print cloth	0	172	830	40
	3	218	650	28
	10	272	550	23
	30	302	460	22
Cloth swelled in 20% caustic Solution, washed and used wet	0	201	1445	44
	3	226	1135	38
	10	250	885	30
	30	256	820	27

Influence

Influence

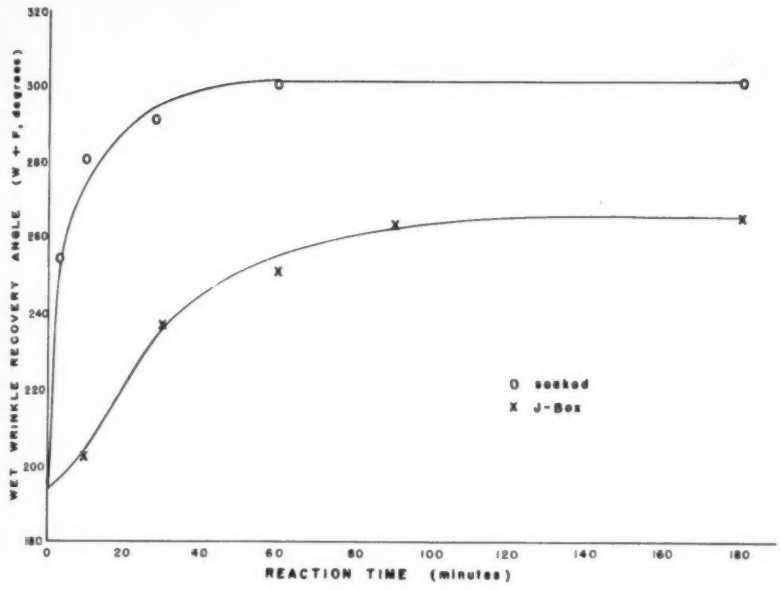

Figure 1
Influence of method of processing upon rate of increase of wrinkle recovery angle of bleached print cloth

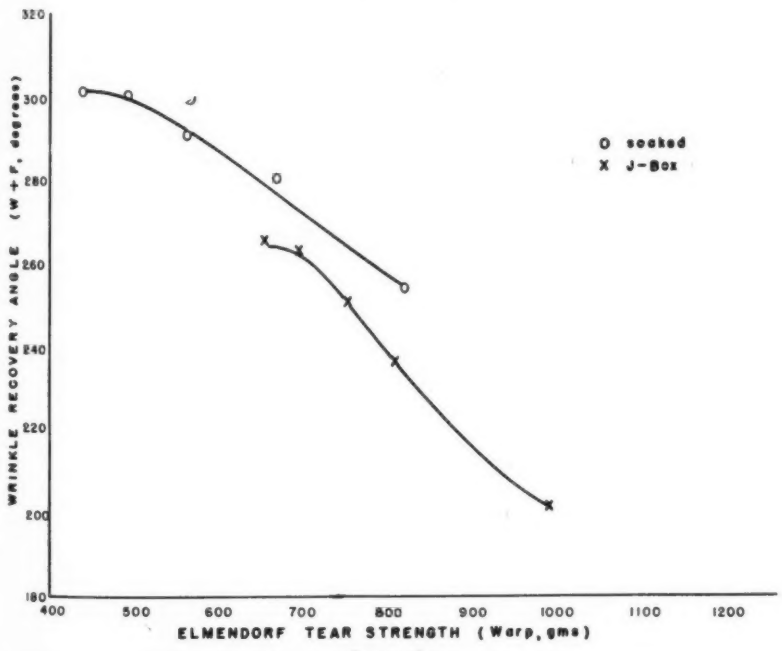

Figure 2
Influence of method of processing upon wrinkle recovery and tear strength of bleached print cloth

cified. The selection of 7.4% HCHO for use was based upon preliminary experiments. Experiments using both higher and lower concentrations of HCHO are described below.

Carbamoylethylated, alkali-swelled, and bleached print cloth were reacted with HCHO for comparative purposes. The carbamoylethylated cloth contained 8% nitrogen and was made by reacting acrylamide with some of the bleached print cloth in the presence of sodium hydoxide. Alkali-swelled fabric was made by immersing some of the bleached print cloth in 20% sodium hydroxide solution, with minimum shrinkage, for about three minutes, then rinsing in running tap water until essentially free of base. The alkali-swelled fabric was not dried; it was used while still wet and in a highly swollen condition. The other two fabrics—bleached print cloth and carbamoylethylated print cloth—were preswelled in water for about five minutes and then run through squeeze rolls to reduce water pickup to about 80% before use. The wet fabrics were rolled loosely and immersed in a beaker of HCHO-HCl solution. Aliquots of each fabric were removed at three, 10, and 30 minutes and placed in running alkaline tap water to stop methylenation and to remove HCl and unreacted HCHO.

Tear and breaking strength and wet wrinkle recovery were determined and are logged in Table II. The bleached cloth underwent a steady reaction reaching a wet wrinkle recovery angle (WRA) of 281° (W+F). At the same time the tear and breaking strength were decreasing rapidly. However, about 53% breaking strength and 555 gms of tear strength was retained after 30 minutes of reaction, which is about equivalent to that usually retained after finishing the same fabric with dimethylolethyleneurea or a triazone to impart dry and wet wrinkle recovery. Carbomoylethylated fabric was made even more wrinkle resistant but the tear strength was somewhat less than the bleached cloth with equivalent wrinkle recovery. Preswelling in mercerizing caustic solution improved the tear and breaking strength retention but the maximum WRA was only 256° after 30 minutes of reaction. The results with this fabric indicate that some advantage might be obtained by using mercerized fabric. Dry wrinkle recovery was essentially unchanged by all of the treatments.

REACTION IN J BOX——The extent of reaction occurring in the soaking process described above was compared to a simulated open-width J-box reaction. In this latter instance, the bleached fabric was padded through the HCHO-HCl solution and allowed to fold in open width and was then covered for predetermined times with a sheet of polyethylene to reduce evaporation, then process washed as described above. The reaction went at a much lower rate in the J box as is shown in Figure 1. For example, it required 90 minutes reaction in the J box to produce fabric with wrinkle recovery equivalent to that obtained in three to five minutes in the soak process. However, adequate wrinkle recovery was finally obtained. The tear strength retained for a given WRA by the two methods is about equivalent. The difference in tear

strength indicated in Figure 2 is about in the range of experimental error. Reading from the curve obtained by reaction in the J box, a tear value of 700 gms was obtained with a wet WRA of 260°. The simulated J box is much more convenient for carrying out this reaction than the soaking procedure.

ADVANTAGE OF MERCERIZED OVER BLEACHED PRINT CLOTH WHEN REACTED IN THE J BOX ———The advantage of using the wet mercerized rather than bleached fabric was indicated above where alkali-preswelled fabric was comparatively stronger than the bleached fabric after reaction with HCHO. To check this point, a series of half-width mercerized print cloth samples were prewet in water, then padded through the HCHO-HCl solution using two dips and nips, held in the J-box for predetermined times, then process washed. A second series of mercerized samples were treated following a slightly different procedure; this time the fabrics were not prewet before padding. Several days later, a third series was treated following the prewet procedure used with the first set of samples; this time freshly purchased HCHO was used. (This formalin did not have solid polymer deposited in the bottom of the container, as was the case in the two previous runs.) Figure 3 illustrates that runs 1 and 2, shown as curves A and B respectively, produced about equivalent wrinkle recovery, especially during the first 30 minutes of reaction. The third series of samples which were made using fresh formalin, were also in good agreement with the first two. This is shown as curve C in Figure 3.

Data obtained on bleached print cloth which has been treated by the J box procedure by first prewetting in water then padding using two dips and two nips is shown as curve D of Figure 3. The rate of increase in WRA is much greater for the mercerized than for the bleached print cloth. In general, the mercerized fabrics acquired a wrinkle recovery of 280° (W+F) within 10 to 20 minutes of reaction time. The bleached had a WRA of about 240° after 30 minutes of reaction. The rate of increase in WRA of mercerized fabric reacted in the J box is as great as was obtained by soaking of bleached fabric. This relationship is clearly shown in Figure 4. In this case the mercerized fabric was not prewet; it was padded one dip and one nip and allowed to stand for predetermined times before process washing. In both cases,

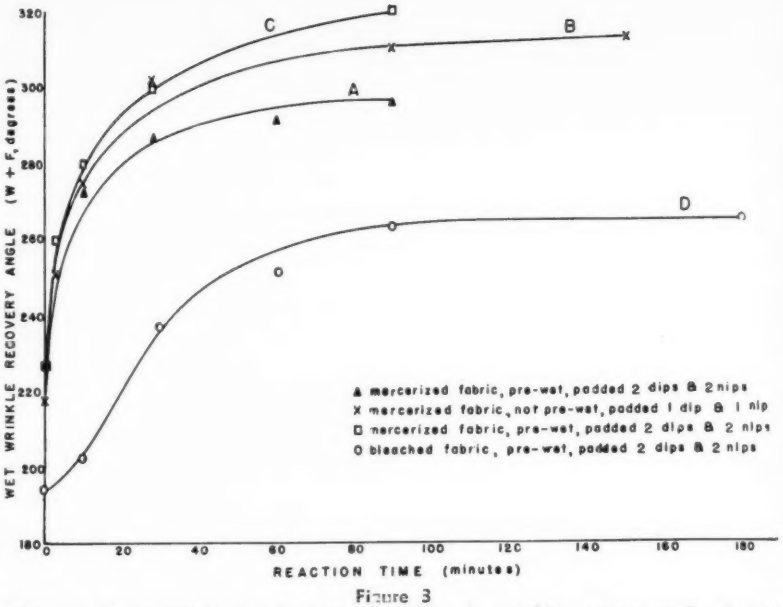
WET WRINKLE RECOVERY ANGLE (W + F, degrees)
REACTION TIME (minutes)
A
B
C
D
▲ mercerized fabric, pre-wet, padded 2 dips & 2 nips
X mercerized fabric, not pre-wet, padded 1 dip & 1 nip
□ mercerized fabric, pre-wet, padded 2 dips & 2 nips
○ bleached fabric, pre-wet, padded 2 dips & 2 nips

Figure 3
Influence of mercerization upon rate of increase in wrinkle recovery angle of print cloth reacted in J box

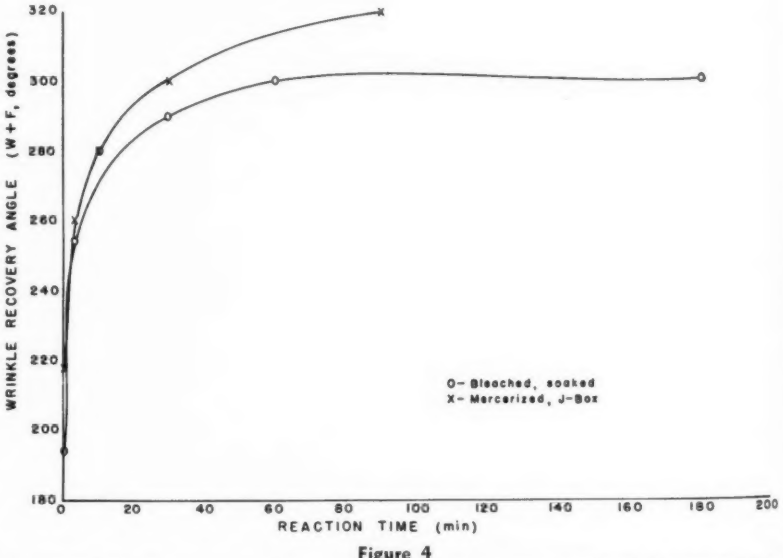

Figure 4
A comparison of the rate of increase in wrinkle recovery angle of bleached fabric reacted by soaking and mercerized fabric reacted by J box

wrinkle recovery angles of about 280° were reached in 10 minutes. One important feature about the two reaction systems which is not shown in Figure 4 is the actual rate of reaction of formaldehyde with the cotton. The combined formaldehyde after three, 10, and 30 minutes of reaction with the bleached fabric by soaking was 0.32, 0.45, and 0.62% for the respective times. In the J box with the mercerized fabric, the reaction was slower; the amount of formaldehyde reacted during the same periods of time was 0.24, 0.38, and 0.44%. Thus the mercerized fabric was given a higher degree of wet wrinkle recovery for a given amount of combined formaldehyde than the bleached fabric.

Bleached fabrics and mercerized fabrics treated in the J box retained about the same total tear strength after any given time of reaction. This is illustrated in Figure 5 where the tear strength values at any selected reaction time are the same within experimental error. This is the situation even though the mercerized fabric had a higher initial strength.

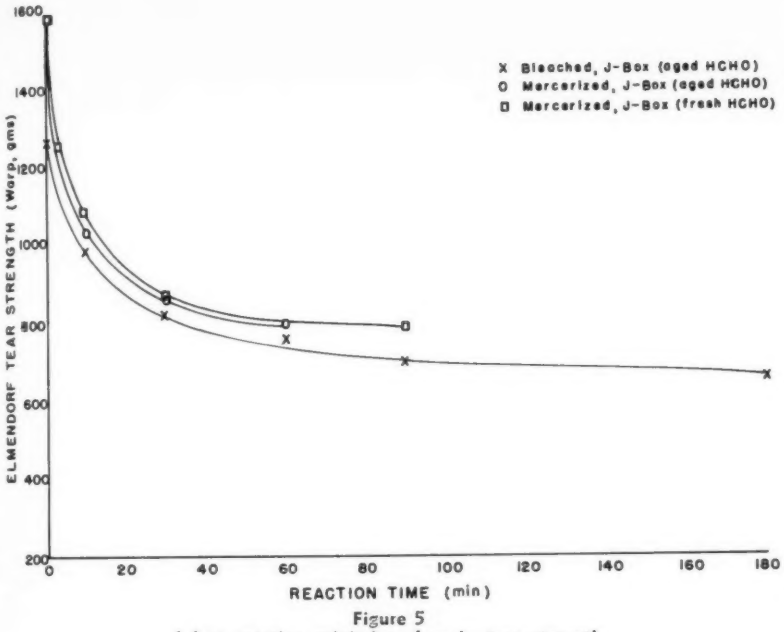
X Bleached, J-Box (aged HCHO)
O Mercerized, J-Box (aged HCHO)
□ Mercerized, J-Box (fresh HCHO)
ELMENDORF TEAR STRENGTH (Warp, gms)
REACTION TIME (min)

Figure 5
J box reaction minimizes loss in tear strength

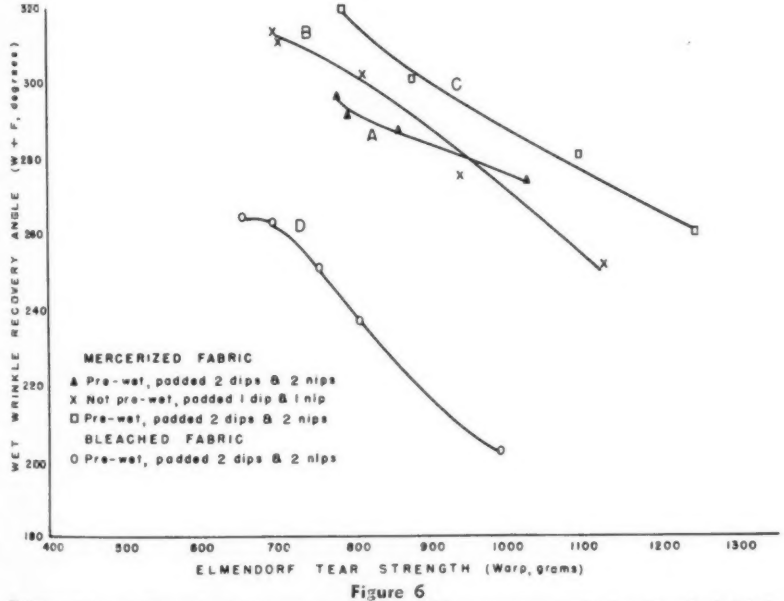
MERCERIZED FABRIC
▲ Pre-wet, padded 2 dips & 2 nips
X Not pre-wet, padded 1 dip & 1 nip
□ Pre-wet, padded 2 dips & 2 nips
BLEACHED FABRIC
O Pre-wet, padded 2 dips & 2 nips
WET WRINKLE RECOVERY ANGLE (W + F, degrees)
ELMENDORF TEAR STRENGTH (Warp, grams)

Figure 6
Relationship of Elmendorf tear strength to wrinkle recovery angle for bleached fabric and mercerized fabric

Figure 6 shows the relationship of Elmendorf tear strength to WRA for the same four series of fabrics described above in Figure 3. The data obtained for the three mercerized fabrics are substantially better than that obtained on bleached cloth. Bleached fabric with wet WRA of about 250° had a warp tear strength of about 750 gms, whereas mercerized fabric with WRA of about 280° had a tear strength of about 950 gms. The mercerized fabric had a tear strength of 1400 gms before treatment with formaldehyde and the bleached had a 1260 gm tear. The relationships between WRA and strength, are similar for tear or breaking strength.

PILOT-PLANT APPLICATION

Two pilot-plant runs were made to determine the quality of fabric that could be produced on a larger scale; mercerized fabric was used in both runs. The treating solution consisted of 7.4% formaldehyde and 19.5% hydrochloric acid. A 50-inch-wide, two-bowl padder was used at a speed of about 100 yds/min. The jig was used to wash the treated fabrics. After washing, the drying was done on a tenter.

In the first pilot plant run 50 yards of fabric were padded through the solution using two dips and two nips. After the second padding it was rolled on a shell. About 20 minutes from the time the fabric went through the pad the first time, it was run into dilute sodium carbonate solution contained in the jig. After four runs through the carbonate solution, it was washed about 20 minutes, first in hot and then in cold water. The fabric had a dry WRA of 172° (W+F) and wet of 301°, as shown in Table III. The tear strength was 780 gm (warp), and breaking strength, 25.5 lbs, with an elongation at break of 4.3%. Flex abrasion was 250 cycles.

The second pilot plant run was done on two 15-yd samples of print cloth—sample A and B. Sample A was prewet in water; sample B was air equilibrated fabric. The samples were sewed together with leaders and therefore processed under identical conditions. In this run the fabrics were given one dip and one nip through the HCHO-HCl solution. Instead of the wet fabrics being rolled on a shell, they were allowed to plait or fold uniformly into a large box. It was immediately moved over to the jig and run into dilute sodium carbonate solution as before. The time elapsed between padding and entering the carbonate solution was about five minutes. Sample A had a wet WRA of 224° and sample B had 256°. Based upon the mercerized control, sample B had 75% retention of tear strength, 81% retention of breaking strength with no change in the elongation at break, and 65% flex abrasion. The formaldehyde content of this fabric was 0.28%

The tear strength and wrinkle recovery of the fabrics produced in the first pilot-plant run and sample B of the second run can be compared with the corresponding values for laboratory prepared fabrics shown in Figure 6. Although the conditions of reaction were not exactly the same there is fairly good agreement in the strength and wrinkle resistance values. Interpolating from curves A, B, and C of Figure 6, a warp tear strength of about 800 gm was obtaned from fabric having about 300° WRA. This is comparable to the pilot plant run in which the tear strength

TABLE III

Physical properties of mercerized print cloth treated with HCHO in a pilot plant application

	Combined HCHO (%)	WRA (w + f) dry	WRA (w + f) wet (degrees)	Elmendorf tear (warp) (gms)	Breaking strength (warp) (lbs)	Elongation at break (%)	Flex abrasion (warp) (cycles)
Mercerized control	—	196	217	1400	44.5	6.5	1455
H_2O prewet; padded one dip, one nip (Run 2A)	—	—	224	1260	43.5	6.5	1725
Not prewet; padded one dip, one nip (Run 2B)	0.28	—	256	1050	36.0	6.6	950
Not prewet; padded two dips, two nips (Run 1)	0.48	172	301	780	25.5	4.3	250

was 778 gm with a WRA of 301°. Sample B of run 2, with 256° WRA and 1050 gms tear, is also in fair agreement with Figure 6 which indicates a wrinkle recovery angle of about 270° for a 1050 gm tear.

DISCUSSION

The present investigation of the reaction of HCHO with cotton fabric is believed to represent another step toward the successful commercial use of formaldehyde for finishing cotton goods. The current process imparts excellent wet wrinkle recovery with only a very small amount of dry recovery. This is perhaps a weak feature of the finish. However, the importance of wet wrinkle resistance is being recognized. Recently Williams (*13*) pointed out that good "wash-and-wear" appearance after laundering requires both dimensional stability and high wrinkle recovery.

N-methylol type compounds impart many excellent properties to cotton fabrics including a high degree of both wet and dry wrinkle recovery and "wash - and - wear" qualities. These finishing agents which include urea formaldehyde, melamine formaldehyde, dimethylolethyleneurea, triazones, and related compounds have the inherent weakness of lack of durability. This means that the excellent initial "wash-and-wear" properties of finished goods will diminish during normal use for most materials. N-methylol type compounds have other weaknesses too. Formaldehyde release, odor development, in some cases, and chlorine retention are also frequent defects.

Epoxy finishing agents have overcome many of the weaknesses of the N-methylol type compounds, but these compounds also have deficiencies. The epoxy finishing agents reported to date reduce the strength of cotton fabric excessively. However, some use is being made of them in blends with N-methylol type compounds. Epoxy compounds are still rather expensive.

The use of formaldehyde and hydrochlrioc acid in a process as suggested here should be quite economical. Cost analyses have not been made, but the chemical cost can be calculated readily. Assuming the use of a solution containing 19.5% HCl, 7.4% HCHO, and an 80% wet pickup on 3.1-oz print colth, the chemical cost is about 1.5 cents/lb of fabric or about 0.3 cents/sq yard.

Some practical use may also be found for HCHO-HCl-treated fabric which has reacted to only a very low degree. For example, fabric which was allowed to react for about three minutes appeared to be changed very little according to WRA. However, when given a post treatment with a triazone, it was found that 2.5% of the resin imparted as much initial wet and dry wrinkle recovery as was obtained with 5% of the same resin on the original cotton fabric. Many other properties are also changed by the low degree of reaction; moisture regain is increased, and dyeing properties are modified.

SUMMARY

The crosslinking of cotton fabric with formaldehyde while in a water-swollen state has been studied. One object of the study was to produce cotton fabric with wrinkle recovery without excessive degradation of fabric strength. A formaldehyde system found to be quite reactive consisted of 19.5% hydrochloric acid and 7.4% formaldehyde. A process referred to as J box process was selected for reacting the HCHO with fabric. The J box process consists of padding fabric through the aqueous HCHO-HCl solution and allowing the goods to plait into a box where the fabric is retained for five to 20 minutes at about 28°C before washing and drying Mercerized fabric was found to be much more suitable for use in the process; wrinkle recovery was acquired at a faster rate and the final tear strength was much greater than when bleached fabric was used. Mercerized fabric is more suitable than bleached fabric because less combined formaldehyde is needed to produce a given degree of wet wrinkle recovery.

Mercerized 80 × 80 print cloth reacted with formaldehyde in the simulated J box for 10 minutes at 28°C and then washed had wet wrinkle recovery of about 270-280° (W+F) and Elmendorfer tear strength of 900-1000 gms in the warp. The mercerized fabric had a warp tear of 1400 gm before treatment. Fabric finished according to this process had little or no dry wrinkle recovery. Mercerized fabric finished in the pilot plant by a procedure similar to that used in the laboratory gave results about comparable to the laboratory prepared fabrics.

The cost of chemicals (HCl and HCHO) used in this process is about 0.3 cents per sq yard of three-ounce cloth.

ACKNOWLEDGMENTS

The authors wish to express their appreciation to Vidabelle O Cirino and James A Harris for many formladehyde determinations, and to members of the Textile Testing Section for assisting with tensile strength and flex abrasion measurements. The authors also wish to express their thanks to Milton J Hoffman and Albert M Walker for mercerizing the fabric and aiding in the pilot-plant application of the finish.

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Proceedings of the
American Association of Textile Chemists and Colorists

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September 5, 1960 No. 18

"New Fibers—New Blends—New Fabrics"

1960 AATCC CONVENTION

Auspices of the Delaware Valley Section
October 6, 7, 8 • Sheraton Hotel, Philadelphia, Pa

AN "INVITATION TO PHILADELPHIA" FROM THE 1960 CONVENTION CHAIRMEN

FRED V TRAUT
Globe Dye Works Co
Chairman

WM H BERTOLET III
Laurel Soap Mfg Co, Inc
Co-chairman

ONLY a month remains to make your plans to attend the 1960 National Convention which is being held in Philadelphia, "the Heart of the Delaware Valley".

Your Convention Committee has worked long and hard (with a great deal of enjoyment) to develop a program that would surpass our best previous efforts.

The "keystone" of this, our annual Convention, is the Technical Program, which features leading scientists and technicians of the industry, who will emphasize and amplify our Convention theme—"New Fibers-New Blends-New Fabrics." This program will be presented in the spacious, comfortable ballroom of the new Sheraton Hotel. The ballroom is convenient to the exhibits, registration desk, and other important Convention functions. All of this for your comfort and pleasure.

Because of the anticipated record attendance, the Reservation Committee has provided additional accommodations at two very fine hotels near the Convention headquarters.

The Entertainment and Ladies Program Committees, not to be outdone, have also come up with something "new" for your leisure hours.

In closing, we are proud to invite you to Philadelphia, and we are going all out to make this the most worthwhile and memorable Convention possible.

FRED V TRAUT, Chairman
WM H BERTOLET III, Co-chairman

M H KLEIN
Chairman
Exhibits Committee

EXHIBITS COMMITTEE, M H Klein, chairman———The anticipated success of this Convention can be attributed in no small part to the Exhibits Committee, headed so ably by M H Klein, Sandoz, Inc. Many of the leading chemical, dyestuff and equipment manufacturers plan interesting and informative displays.

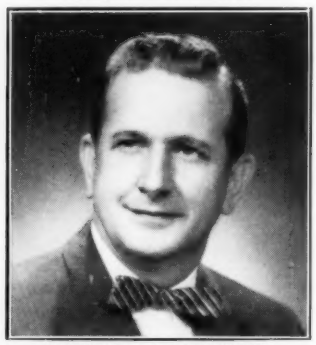
TRANSPORTATION COMMITTEE, Wm H Brehm II, chairman——Chairman Brehm, Brehm & Stehle Dye Works, reminds us that Philadelphia possesses unlimited historic, scientific and cultural places of interest to visit. Among them are the Liberty Bell, hanging in Independence Hall, which overlooks the newly formed Mall; the Society Hill section, which is restoring and reconstructing early Philadelphia; Christ Church, Gloria Dei, St George, St Joseph's in Willing's Alley, to name a few of the old historic churches; the Fels Planitorium in the Franklin Museum; the Philadelphia Textile Institute with its research laboratories; the Commercial Museum connected with the University of Pennsylvania; the Academy of Natural Sciences; the Philadelphia Art Museum, overlooking the Benjamin Franklin Parkway and Fairmount Park; the Pennsylvania Academy of Fine Arts; the Philadelphia Zoological Gardens.

Chairman Brehm and his Committee will be at your service to assist you in obtaining transportation for the many activities which will be available.

RECEPTION COMMITTEE, Thomas H Hart, chairman———The Reception Committee for the 1960 National Convention has been planning for the past few months not only to provide for the comfort and enjoyment of the many members, ladies and guests, who plan to attend, but also to act as a Service Committee to keep things running along in a good, smooth manner.

WILLIAM H BREHM II
Chairman
Transportation Committee

JOHN G FERGUSON
Co-chairman
Reception Committee



DONALD W ROBINSON
Chairman
Finance Committee

L KEVIN McCHESNEY
Chairman
Publicity Committee

THOMAS H HART
Chairman
Reception Committee

The twelve members of this Committee will be well briefed for their various duties and working as a team will try to make the Convention one long remembered.

The Reception Committee consists of—

Thomas H Hart, chairman, Hart Products Corp

John G Ferguson, co-chairman, Putnam Chemical Corp

Joseph A Clark, Leatex Chemical Co

James E Conway, American Cyanamid Co

Millard E Haines, Argo Mills Div

J Walter Huber, Onyx Chemical Corp

Wm D Humphreys, G J Littlewood Co

John Linton III, Carbic-Hoechst Corp

Ralph Nebelung, Sandoz, Inc

Philip H Orser, Frankford Woolen Co

Donald V Speese, Geigy Chemical Corp

Frank Vellner, Vellner and Co

Honorary Members are the AATCC president, the four vice presidents and the executive secretary.

FINANCE COMMITTEE, Donald W Robinson, chairman——— The Convention Committee is solvent! The report of the Finance Committee given by Donald W Robinson, Para-Chem, Inc, at the most recent Convention Executive Committee meeting was one of precision, clarity and brevity. Deposits are made promptly and payments made only on correctly endorsed invoices. The Finance Committee should be congratulated on its attention to this very important Convention function.

PUBLICITY COMMITTEE, L Kevin McChesney, chairman———Kevin McChesney, Leatex Chemical Co, reports that material including technical papers, pictures, etc, for Convention publicity is being mailed to all interested publications.

AATCC Calendar

COUNCIL, COUNCIL COMMITTEES, RESEARCH COMMITTES

Sept 8-10 (Atlanta-Biltmore Hotel, Atlanta, Ga); Sept 8-9—Council Committees and Research Committees; Sept 9—Council; Sept 10—TCR

Nov 17-18 (Sheraton-Atlantic Hotel, New York, NY); Nov 17—Council Committees and Research Committees; Nov 18 (AM)—ECR, TCR; Nov 18 (PM)—Council and Annual Meeting

NATIONAL CONVENTIONS

Oct 6-8 (Sheraton Hotel, Philadelphia, Pa); Sept 28-30, 1961 (Hotel Statler, Buffalo, NY); 1962 (Southern Region); 1963—Boston; 1964—New York; 1965—Chicago

DELAWARE VALLEY SECTION

Sept 16 (Reading, Pa); Nov 4, Dec 9 (Philadelphia, Pa)

NIAGARA FRONTIER SECTION

Sept 23 (Buffalo, NY); Nov 4 (Annual Business Meeting, Buffalo, NY); Apr 7 (Joint meeting with Ontario Section, CATCC, St Catherines, Ont); May 18 (Buffalo, NY)

NORTHERN NEW ENGLAND SECTION

Sept 9 (Outing—Wachusett Country Club, West Bolyston, Mass); Oct 21 (Hotel 128, Dedham, Mass—"Customer Service"—Arthur Swenson, J P Stevens & Co, Inc, and P J Fynn, J C Penney Co); Dec 9 (Colonial Country Club, Lynnfield, Mass—"Present-day Economic Otulook in Textiles"—William I Kent, Kent Mfg Co); Jan 20 (Hotel 128, Dedham, Mass—Symposium on "Mechanical and Chemical Finishing of Textile Fabrics"—John J McDonald, Lowell Technological Inst, D D Gagliardi, Gagliardi Research Corp, and Werner von Bergen, J P Stevens & Co, Inc)

PACIFIC SOUTHWEST SECTION

Sept 24-26 (Outing—Apple Valley, Calif); Nov 18 (Rodger Young Auditorium, Los Angeles, Calif); Dec 10 (dance)

PIEDMONT SECTION

Sept 23-24 (Hotel Charlotte, Charlotte, NC); Jan 21 (Poinsett Hotel, Greenville, SC); April 2 (Washington Duke Hotel, Durham, NC); June 9-10, 1961 (Outing—Grove Park Inn, Asheville, NC); Sept 23, 1961 (Hotel Charlotte, Charlotte, NC)

RHODE ISLAND SECTION

Sept 23 (Management Night); Oct 28 (Providence Engineering Society); Dec 2 (Annual Meeting—Johnson's Hummocks)

SOUTH CENTRAL SECTION

Sept 17 (Andrew Johnson Hotel, Knoxville, Tenn); Dec 9 (Hotel Patten, Chattanooga, Tenn)

SOUTHEASTERN SECTION

Sept 10 (Atlanta-Biltmore Hotel, Atlanta, Ga); Dec 3 (Atlanta Athletic Club, Atlanta, Ga)

WESTERN NEW ENGLAND SECTION

Sept 23 (Blake's Restaurant, Springfield, Mass); Oct 21 (Annual Meeting, Rapp's Restaurant, Shelton, Conn); Dec 2 (Rapp's Restaurant, Shelton, Conn)

Activities of the Local Sections

Northern New England

THE 1960 Outing of the Northern New England Section will be held on Friday, September 9, at the Wachusett Country Club, West Boylston, Mass. Cochairmen for the affair are Donald H Thomas, National Aniline Div, Allied Chemical Corp, and John R Markgren, W C Durfee Co. Nonmembers wishing to attend are invited to place their reservations through either of the cochairmen.

Golf, softball, horseshoe pitching, fly casting, and a putting contest are the sporting events arranged by the Committee. Dinner is scheduled for 7:00 pm, at which winners of the various events will be awarded prizes. Except for the greens fee for golf, all other events are free. Dinner tickets are priced at $6.50.

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South Central

SOUTH CENTRAL SECTION will meet September 17 at the Hotel Andrew Johnson, Knoxville, Tenn, with Jack McNab, Mac Chemical Co, serving as program chairman.

The technical session will be an open forum discussion of general dyehouse problems. The Section's membership has been invited to submit problems regarding dyeing, bleaching, finishing, etc for discussion.

CI Nomenclature Adopted by US Tariff Commission in Publication

The *Colour Index, Second Edition* nomenclature has been adopted exclusively by the U S Tariff Commission publication "Synthetic Organic Chemicals, U S Production and Sales" and by the Bureau of Customs on American offerings and importations. The *Colour Index* has been published by AATCC and The Society of Dyers and Colourists in four volumes totaling 3152 pages.

These four volumes establish a new international language for dyes and pigments and include information on methods of application, colorfastness, chemical structure, characteristic reactions, index of products and trade names, fastness tests and rating methods, new and old *Colour Index* numbers, Schultz and AATCC prototype numbers, and a hue indication chart. Manufacturers, marketers, importers, purchasers, research chemists, market analysts, customs attorneys, patent attorneys, reference libraries, and technical publications concerned with the organic dyes and pigments industry will find the *Colour Index* indispensable for their work.

CORRECTION

IN the July 25 issue, page 31, under the heading "Nominees for National Offices", the business affiliation of Elliott Morrill, candidate for the AATCC presidency for 1961, is not correct.

Mr Morrill is with the Corn Products Company.

Employment Register

This column is open for two insertions per year, per member, without charge. Blanks may be obtained from, and filed with, the secretary of the Association, Post Office Box 28, Lowell, Mass. It is understood that these will be open to inspection by prospective employers who can obtain further information from the secretary.

60-13

Education: BA, Chemistry.

Experience: Lab technician; manager lab dyeing and managing supt dyeing.

Position desired: Superintendent of dyeing and finishing or dyer

Location: Canada (Quebec or Ontario Province) or Northeastern States

Age: 29; married; two dependents; references.

8-22, 9-5

AATCC Deceased

Member	*Section*
JOSEPH C McINERNEY McInerney Insurance Agency Inc 253 Appleton St Lowell, Mass	NNE
OTTO C HAUFE Turner Halsey Co 40 Worth St New York 13, NY	Met

Membership Applications

JULY 28-AUGUST 3, 1960

NEW ENGLAND REGION

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Transfer to Senior

Walter E Bill—Dept sales mgr, Geigy Chem Corp, Ardsley, NY. Sponsors: S Mooradian, R Ferris.

Joseph A Bryant Jr—President, Bryant Chem Corp, N Quincy, Mass. Sponsors: A C Merrill Jr, R Weiss.

John Evans—Chemist & lawyer, The Plymouth Chem Corp, E Boston, Mass. Sponsors: W L Williams, H M Hartnett.

William G Evans—Assoc mgr & owner, The Plymouth Chem Corp & Plyco Products Inc, E Boston, Mass. Sponsors: W L Williams, H M Hartnett.

Laurence F McMahon—Chemist, Haartz Auto Fabric Co, Newton, Mass. Sponsors: J J O'Neill Jr, G J Mandikos.

John F Peledge—Drycleaner, Nu-Way Cleaners Inc of Medford, W Medford, Mass. Sponsors: J J O'Neil Jr, G J Mandikos.

Walter B Warren—Tech dir, gen mgr, Warren Chem Mfg Inc, Norwood, Mass. Sponsors: J J O'Neil Jr, G J Mandikos.

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Mitchell Hirschkorn — Finishing supv, knitted fabrics, Indian Orchard Finishing Co, Indian Orchard, Mass. Sponsors: V J Pappas, W H Espelin.

William F Lapierre—Quality control supv, Alamac Knitting Mills, Inc, Indian Orchard, Mass. Sponsors: V J Pappas, W H Espelin.

Allen Leibowitz—Mill supt, Indian Orchard Fin Co, Indian Orchard, Mass. Sponsors: V J Pappas, W H Espelin.

Ralph F Steigmeyer—Processing supt, Indian Orchard Fin Co, Indian Orchard, Mass. Sponsors: V J Pappas, W H Espelin.

William Thal—Vice president, Alamac Knitting Mills, Inc, Indian Orchard, Mass. Sponsors: V J Pappas, W H Espelin.

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Robert M Kent—Southeast region sales rep, Stauffer Chem Co, New York, NY. Sponsors: R E Hodgson Jr, W E Tiller.

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NOT AFFILIATED WITH A SECTION

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•

AUGUST 4-10, 1960

SOUTHERN REGION

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South Central Section

Senior

Carolyn A Werman—Asst textile chemist, College of Home Economics, Univ of Tennessee, Knoxville, Tenn. Sponsors: R L Galbraith, P E Keeney.

NOT AFFILIATED WITH A SECTION

Associate

Hiroshi Mitani—Chemist, C Itoh & Co Ltd, Osaka, Japan.

Transfer to Associate

Kulathinal M Matthew—Senior lecturer, Government of Kevala, Institute of Textile Technology, Trivandrum, South India.

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AUGUST 11-17, 1960

Metropolitan Section

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Associate

Jerome E Levy—Sales mgr, Sonneborn Chem & Refining Corp, New York, NY.

Delaware Valley Section

Senior

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William F Lehr—Sales & dev, Air Reduction Chem Co, New York, NY. Sponsors: C Kuzma Jr, D W Robinson.

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Senior

Milton M Waldman — Research chemist, Armour Industrial Chem Co, Chicago, Ill. Sponsors: W H Linfield, J C Sherrill.

Associate

William G Schoon—Asst dyer, Portage Hosiery Co, Portage, Wis.

NOT AFFILIATED WITH A SECTION

Junior

Brodsky Brodsky—Production mgr, General Pacific Chem, SA, Lima, Peru. Sponsors: M G Bruckman, K E Leslie.

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No designation after name indicates Senior
(A) indicates Associate
* indicates transfer from another class of membership

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William E Eaton
Earl B Lindquist
John B Hammett (A)

Rhode Island Section

Richmond Harrison
*Charles H Wilson**

Western New England Section

*Albert A Marquis**

CENTRAL ATLANTIC REGION

Metropolitan Section

John S Booth

SOUTHERN REGION

Piedmont Section

Samuel E Somers

NOT AFFILIATED WITH A SECTION

Jacques W Cornut

News of the Trade

Witco Acquires Sonneborn

Witco Chemical Co, Inc, has acquired 100% interest in privately owned Sonneborn Chemical and Refining Corp and its subsidiaries in exchange for 300,000 shares of Witco stock, according to a joint announcement by Robert I Wishnick, Witco board chairman, and Rudolf G Sonneborn, president of Sonneborn.

Also reported in the announcement was the election to Witco's board of directors of three Sonneborn officials —namely, R G Sonneborn; Gustave Schindler, vice president; and Henry Sonneborn III, vice president and secretary. In addition, Mr Schindler and Henry Sonneborn have joined Witco's executive committee.

Founded in 1903, the Sonneborn corporation had sales of $37,478,000 for the fiscal year ended January 31, 1960, with earnings after taxes of $858,000. Among the products it manufactures and markets are white oils, solvents, lubricating oils, petroleum sulfonates, petrolatums, building-products specialties, micro-crystalline waxes and other petroleum specialties. Refining facilities are located at Petrolia and Franklin, Pa, and a chemical specialty plant at Belleville, NJ.

Sonneborn's place in the Witco corporate structure is that of an independently operated, wholly owned subsidiary. Its staff will continue without change.

Witco's net sales and other income for the first-half of 1960 came to $30,766,300 with earnings of $1,219,500. Its products, aside from the newly acquired Sonneborn line, include detergents and detergent chemicals, metallic soaps, paint chemicals, resins for urethane foam, asphalt, emulsifiers, tar chemicals, phthalic anhydride and carbon blacks.

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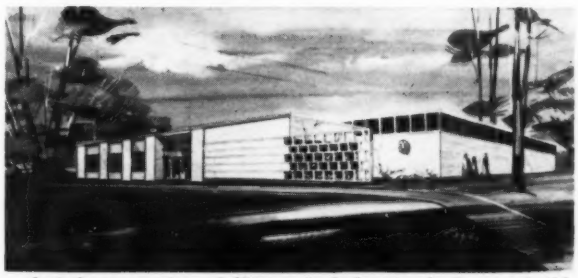
Ultrasonic Industries Breaks Ground for New Plant

Work has begun at Engineers Hill, Plainview, NY, on a new plant for Ultrasonic Industries Inc, manufacturers of diSONtegrator ultrasonic cleaning machines.

The growth of UI since its inception in November, 1959, has called for the expansion to a new plant of 18,000 square feet with additional land set aside for doubling this capacity. The company, now located in Albertson, NY, expects to occupy their new facilities early this fall.

The 25-acre Engineers Hill project, located directly on the Long Island Expressway, is currently building over 200,000 square feet of new plants and warehouses.



Artist's conception of Ultrasonic Industries Inc's new building at Engineers Hill, Plainview, NY, to be completed early this fall.

Seen looking over the plans for Ultrasonic Industries Inc's new building at Engineers Hill, Plainview, NY, are (left to right) Ed Gray, Long Island Lighting Co; Donald E Axinn, builder; Ed Ocker, Councilman from the Town of Oyster Bay; Paul M Platzman, president of UI; Barbara A Jewett, secretary-treasurer of UI; Herbert A Frankel, vice president of sales of UI; John Yule, Long Island Association, and Bill Wansor, Long Island Lighting Co.

Mayor George Christopher of San Francisco receives an Australian "drip-dry" woolen shirt presented to him by the Australian Government Trade Commissioner for San Francisco, B G Dawson.

The development of so-called "washable, easy-care" woolens fabrics is the culmination of several years of research by the Commonwealth Scientific and Industrial Research Organisation (CSIRO), a research authority established by the Australian Government. The new treatment, known as "Sironized", is said to be applicable to the finest Australian Merino wool and to produce a cloth which is competitive with synthetic fibers in every way.

COMPLETE LTI DYEING AND FINISHING WORKSHOP—A two-week summer professional development workshop in textile dyeing and finishing conducted by John J McDonald, head of the finishing department at Lowell Technological Institute, Lowell, Mass, and sponsored by the LTI division of textiles was completed by those shown, left to right: William A Hio, director, St John's Craft Center, Nago, Okinawa; Vytautas I Cirpulis, Shell Chemical Co; Julius A Lindquist, Shell Chemical, Union, N J; Juan I Rosal, Textil Colonia Rosal S A, Barcelona, Spain; Jerry Peck, Newton Line Co, Homer, NY; Professor McDonald; Maurice Briere, Arms Textile Mfg Co, Manchester, NH; and Anton W Bcender, Pepperell Mfg Co, Inc, New York. The course, given the first two weeks of July, dealt with theory and practical applications.

GE Plant for Manufacture of Basic Silicone Intermediates Started

General Electric has started construction of what it believes will be the most advanced plant in the world for the manufacture of basic silicone intermediate chemicals. The new plant, costing nearly $3 million, will replace smaller existing facilities which will be converted to serve other manufacturing needs at the Company's Silicone Products Department in Waterford, New York.

According to Jerome T Coe, general manager of GE's Silicone Products Department, the new facility will add more than 15,000 square feet of manufacturing space to the Waterford site and will increase capacity for the manufacture of intermediate silicones to beyond 1965 levels. It is expected to go into operation by late 1961.

Coe said the new plant will utilize the most advanced equipment and technology of the silicone industry. One of its features will be a closed-circuit TV hookup for monitoring operations from a centralized control room.

The main portion of the facility will consist of a six-story outdoor-type manufacturing structure, a partial two-story control and general service structure, and storage tank area. Steel and corrugated asbestos construction will be used.

Chemicals to be manufactured in the new plant are silicone intermediates. They are processed by the Company into more than 250 saleable forms of silicone, including fluids, resins, oils, emulsions and specialty products.

The new plant construction is part of a 24-month, multimillion dollar expansion program involving the addition of new structures, equipment and processes, first announced by the Company in April. The first phase of the program was a $1 million silicone fluids finishing building which is under construction and is expected to go into operation next November.

The Waterford G-E plant is a completely integrated silicone production operation. To meet still increasing demands its capacity has been increased steadily since World War II.

The new intermediates plant will be the establishment's eighth manufacturing structure and one of 16 major structures at the site.

In addition to its position as the center for G-E silicone manufacturing and research, the Waterford operation is also headquarters for the national sales organization of the Department. Continuing in fundamental research in silicones are the facilities of the General Electric Research Laboratory in Schenectady, which pioneered silicones for the General Electric Company.

Pennsalt Chemicals Completes Modernization of Chlorine-Caustic Facilities

Modernization of its largest chlorine-caustic plant in Wyandotte, Mich, has been completed on schedule by Pennsalt Chemicals Corp, Philadelphia, Pa. The largest single modernization project undertaken by Pennsalt, it included the replacement of some 5,000 old diaphragm-type electrolytic cells with 200 large, modern, 30,000-ampere cells.

Installation of the new cells, the last series of which was put into operation on June 30, was preceded earlier this year by the installation of modern caustic evaporating and brine-treatment facilities. The total program cost $6,000,000.

In addition to providing increased output of chlorine, caustic soda, and hydrogen, the new cells reportedly will afford considerably greater operating economies.

A wide range of industries are consumers of the chlorine and caustic soda produced in the Wyandotte plant. Output of the unit also supplies raw materials for a number of Pennsalt processes, including those making ammonia, ammonium chloride, calcium hypochlorite, hydrochloric acid, ferric chloride, and sodium hypochlorite.

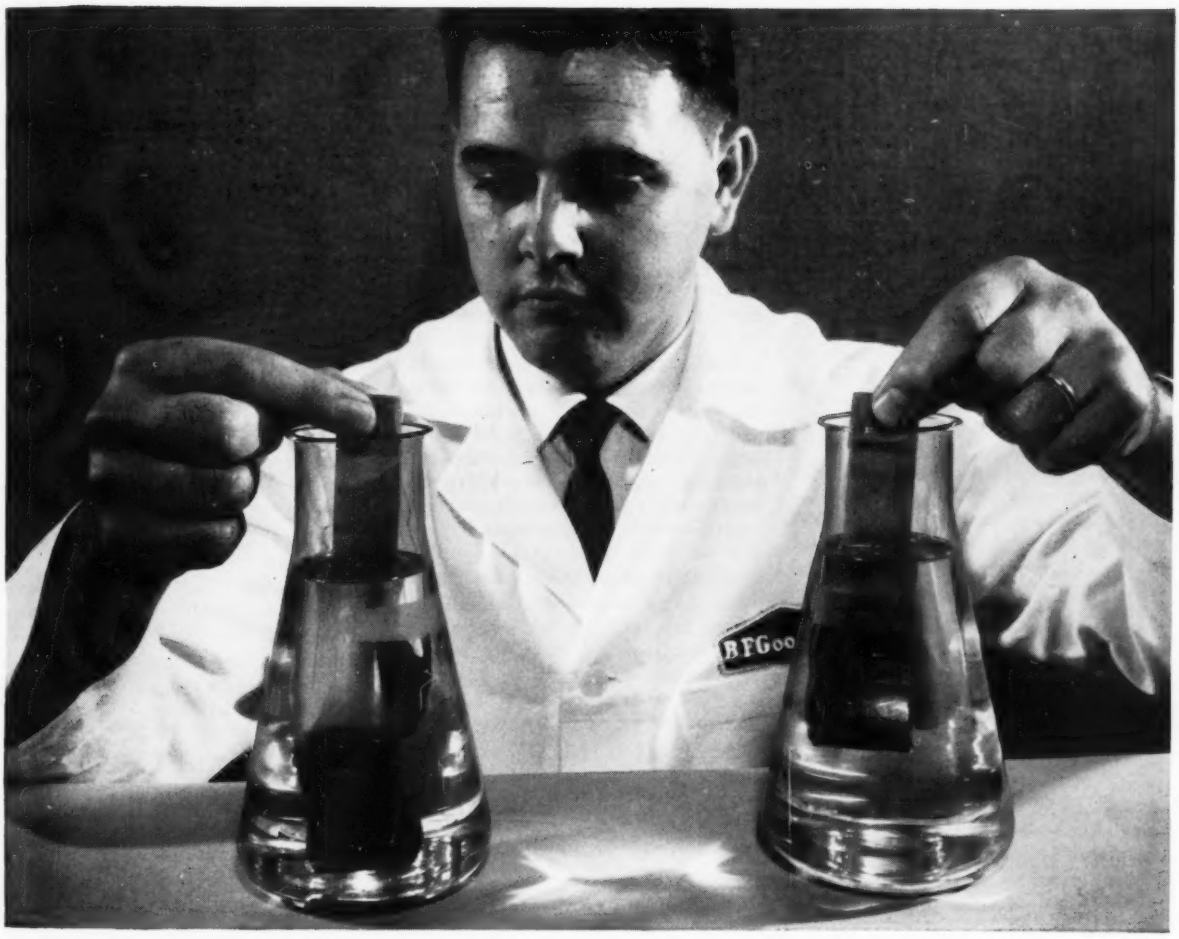
Pennsalt Chemicals and N V Fabriek van Chemische Producten of Vondelingenplaat, Holland, have announced a plan by which Pennsalt will acquire a substantial interest in the Dutch chemical firm known as "Vondelingenplaat".

The Vondelingenplaat plant, located on the Nieuwe Maas waterway near Rotterdam, makes dyestuffs, plastic films, pesticides, rubber chemcals, formic and oxalic acids and their derivatives, and a host of organic chemical intermediates. Pennsalt, a leading producer of fluorine chemicals, also makes chlorine and caustic soda, a complete line of alkyl amines and derivatives, organic sulfur compounds, rubber chemicals and a number of other industrial organic and inorganic chemicals.

Plans call for the immediate construction of facilities for the manufacture of tertiary dodecylmercaptan and other organic sulfur compounds at Vondelingenplaat and also the expansion of facilities for the manufacture of dyestuffs, plastic films and oxalic acid. Pennsalt makes tertiary dodecylmercaptan in the US. Initial investment in the construction of new facilities at the existing site of Vondelingenplaat is expected to exceed $2 million.

Another new development using

B.F.Goodrich Chemical *raw materials*



Even cleaning solvents can't affect new binder

This new self-curing Hycar acrylic binder eliminates the need for involved compounding to develop solvent resistance and washability. Its excellent behavior is demonstrated above.

The weighted nonwoven at left is made with conventional binder. When immersed in dry cleaning solvent, it failed immediately. The weighted nonwoven at right is made with the new Hycar binder. Immersed in the same solvent for a week, the construction was unchanged.

In addition, the new latex reduces processing costs, increases stability and is colorless.

Complete information about application of new Hycar 2671 is available now. You can learn more about improving nonwovens, upholstery or drapery back coatings, and adhesives with it. It's another example of service you can get to produce better textiles for wider appeal. Write Dept. KC-9 B.F. Goodrich Chemical Company, 3135 Euclid Avenue, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

PRODUCTS FOR TEXTILE IMPROVEMENT

B.F.Goodrich Chemical Company
a division of The B.F.Goodrich Company

B.F.Goodrich GEON vinyls • HYCAR rubber and latex • GOOD-RITE chemicals and plasticizers

Space Increased for Greenville Show

More than four thousand square feet of additional exhibit space has been arranged for the 21st biennial Southern Textile Exposition to be held at Greenville, SC, October 3-7.

The exposition is held in Textile Hall and its eight permanent annexes, which cover the larger part of a city block in downtown Greenville and provide in excess of 100,000 square feet of space.

Officials of Textile Hall Corporation, which sponsors the show, decided against building another annex for the 1960 exposition. Unprecedented demand for space, however, reportedly has led to a decision to lease a building directly across the street from Textile Hall's main entrance. This building will serve as Annex No. 9.

Bertha M Green, director of the exposition, said the additional exhibit area was necessary to meet the need of several manufacturers of heavy machinery. The space, she added, will be used primarily for operating machinery.

The Greenville show two years ago attracted some 340 U S and foreign exhibitors of machinery, equipment, accessories and supplies.

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Colony Chemical Corp Relocates

Colony Chemical Corp, Fall River, Mass, has relocated its offices and warehouse in larger quarters at 91 Wordell St.

Joseph Boulanger, executive vice president, stated that the new facilities covering 25,000 square feet of space, with dock facilities for six trucks, will enable the firm to better service the industrial needs of the Fall River area.

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Scope of Glycerine Research Awards Broadened

The scope of the Ninth Annual Glycerine Research Awards, scheduled to be awarded in January of 1961, will be broadend to give special recognition and emphasis to practical applications for glycerine and its derivatives, according to E Scott Pattison, manager of the Glycerine Producers' Association. Two awards, of $750 and an honor plaque, will be given this year in recognition of outstanding work—one in the field of basic research, the other for practical glycerine application.

The Awards, established by the Glycerine Producers' Association in 1952, are given annually for new and independent research contributing to knowledge and use of glycerine and its derivatives.

Although entries covering practical application of glycerine or its derivatives had not been excluded from previous competitions, the high scientific level of biochemical and medical research which has marked winning entries in previous years may have tended to discourage entries dealing with more practical phases of glycerine application.

He stated that new approach gives equal emphasis to development in basic and applied research and will encourage entries dealing with more practical commercial product development.

According to Mr Pattison, nominations can be made for individuals or teams either directly by the researchers or by third parties in their behalf, based on either published or unpublished data. Closing date for nominations is November 1, 1960. Further details and entry forms for the awards can be obtained from the Glycerine Producers' Association, 295 Madison Avenue, New York 17, N Y.

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2nd Canadian Textile Conference

"Style-Quality-Progress" — under this theme, representatives of all sections of the Canadian primary textile industry will gather at the Queen Elizabeth Hotel, Montreal, Feburary 7-8-9, 1961, for the second Canadian Textile Conference.

The three-day meeting is a successor to the May, 1958, Conference, which attracted some 1,500 registrants and guests, one of the largest, most comprehensive gatherings ever staged by the Canadian textile industry.

A major objective of the Conference is to demonstrate the size, scope, social and economic importance of the textile industry in Canada, and the variety, quality and styling of Canadian textiles.

Although basically an industrial conference, delegates will hear addresses from high federal and provincial government representatives, prominent Canadian industry figures, and will receive papers from world authorities on all phases of industry business—technology, marketing, education and management.

Public interest will center around a series of fashion shows which will present the latest from the finest Canadian fashion houses.

Although the Canadian Textile Conference will center in Montreal, activities coinciding with the event will be staged in every major textile center in Quebec, Ontario and the Maritime provinces.

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L&N to Establish Two New Branch Offices

Plans to establish two more branch offices and four new residencies were announced recently by Leeds & Northrup Co, Philadelphia, Pa, instrument manufacturers.

New branches soon will become operative at Dallas, Tex, and East Chicago, Ind, while new residencies will be set up at Syracuse, NY, Minneapolis, Minn, San Diego, Calif, and Phoenix, Ariz. In addition, the company has expanded its North Jersey office at East Orange, NJ, from branch status to district office.

The new arrangement will give L&N personal sales representation at 41 locations throughout the US.

General Calendar

AMERICAN COTTON MANUFACTURERS INSTITUTE
Mar 23-25 (12th Annual Meeting, Fontainebleau Hotel, Miami Beach, Fla)

CANADIAN TEXTILE CONFERENCE
Feb 7-9 (Queen Elizabeth Hotel, Montreal, Quebec, Canada)

CHEMICAL EXPOSITION USA
Sept 13-15 (Statler Hilton Hotel, New York, NY)

THE FIBER SOCIETY
Oct 27-28 (Fall Meeting, Washington Hotel, Washington DC)

INSTRUMENT SOCIETY OF AMERICA
Sept 26-30 (Annual Meeting, Instrument-Automation Conference and Exhibit, New York, NY)

INTERNATIONAL TEXTILE MACHINERY EXPOSITION
1962 (3rd Exposition, Hanover, Germany)

NATIONAL COTTON COUNCIL
Sept 28-29 (9th Chemical Finishing Conference, Statler Hotel, Washington, DC)

SOUTHERN TEXTILE EXPOSITION
Oct 3-7 (Greenville, SC)

SYNTHETIC ORGANIC CHEMICAL MANUFACTURERS ASSOCIATION
Sept 13, Oct 11, Nov 10, Dec 8 (Hotel Roosevelt, New York, NY)

TEXTILE TECHNICAL FEDERATION OF CANADA
Sept 7-8 (Seventh Canadian Textile Seminar, Queen's Univ, Kingston, Ont, Canada)

TEXTILE OPERATING EXECUTIVES OF GEORGIA
Oct 22 (Harrison Hightower Bldg, Georgia Inst of Technology, Atlanta, Ga)

WORLD CONGRESS FOR MAN-MADE FIBERS
May 15-18, 1962 (2nd World Congress, London, England)

NEW PRODUCTS, DEVELOPMENTS, PROCESSES

New Treatment Makes Permanent Pleats and Creases in Wool Fabrics

Wool slacks and skirts are said to be permanently creased or pleated by a new chemical treatment developed by U S Department of Agriculture scientists. The creases reportedly stay through long wear and exposure to rain and high humidity, and if the fabric is suitably shrinkproofed, the creases remain after machine washing.

The process was devised at the Wool and Mohair Laboratory of USDA's Agricultural Research Service in Albany, Calif, by N H Koenig, W L Wasley, and C E Pardo. They found that dilute solutions of ethanolamine will put long-lasting creases in wool. Ethanolamine is a widely available, safe, inexpensive chemical.

Dr Koenig and his coworkers, in their tests, used a 0.5 to 2.0 percent solution of ethanolamine in water, with a very small amount of detergent to facilitate wetting. The solution can be applied either by spraying or dipping, after which the damp fabric is steam-pressed. In a typical experiment with lightweight suiting, creases reportedly were set in one minute at about 280°F in a tailor's press.

The treatment is applicable to fabrics that have been shrinkproofed by epoxy-polyamide resins, a method developed earlier by the Wool and Mohair Laboratory. Fabrics that have received both treatments are washable in machines without shrink and without loss of creases, it is claimed.

Tests in commercial drycleaning equipment have given promising results, but more testing will be undertaken. The developers have applied for a public-service patent, which would permit commercial use of the method on a royalty-free basis.

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Fire Retardant RC

Burkart-Schier Chemical Co, Chattanooga, Tenn, has announced the development of a low-cost inorganic fire retardant of the renewable type, which it recommends for treating all natural and most synthetic fibers. It reportedly imparts exceptionally good resistance to fire and flame, with complete control of after-glow.

A reported feature of Fire Retardant RC is its resistance to high-temperature drying conditions. Whereas some fire retardants tend to discolor and/or tender textile fabrics under high heat or extended heat exposure in drying or curing, Fire Retardant RC has a definite protective action minimizing this effect, it is claimed. This reportedly overcomes a major defect of the usual soluble-salt type inorganic renewable fire retardants.

For extreme conditions, Burkart-Schier recommends Fire Retardant RCX, which is said to protect fabrics under extreme drying conditions while imparting the same high level of resistance to flame as well as control of afterglow.

Fire Retardant RC is 100% active and there is said to be an appreciable weight gain for goods processed with it, depending upon amount applied. Application is said to be simple; the product dissolves readily, is applied by padding, and normally presents no application problems.

Although not washfast, Fire Retardant RC fills the need for an inexpensive, readily applied, highly effective renewable-type fire retardant, it is claimed.

Burkart-Schier has announced immediate availability of the product. Sample and detailed information will be sent by the company upon request.

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Harshaw Zinc Fluoborate 40% Used for Curing W&W Finishes

Useful applications of Harshaw Zinc Fluoborate 40% have been extended to include curing "wash-and-wear" finishes on textiles. At present it reportedly is being used with epoxies, ethylene urea, dimethylolethylene urea, and other resins, and these applications suggest its possible use for elevated temperature curing of surface finishes applied as emulsions.

Zinc fluoborate is said to offer textile manufacturers these benefits: 1) short curing time—one to two minutes at the curing temperatures required; 2) high crease resistance; 3) low chlorine retention. Some users also report that there is less tendency for polymerization to occur in the bath when zinc fluoborate is used.

Curing is achieved when, at elevated temperatures, zinc fluoborate releases boron trifluoride, the active agent that catalyzes the cure. In finishing, the cloth is immersed in the emulsion, the excess is squeezed out and the cloth is dried in a tenter frame dryer at 300°F. If desired, the cloth may then be exposed to compressive shrinkage. Curing takes place in a curing oven at 325-350°F. Some finishers feel that it is necessary to after-wash to remove reaction products that are not bound into the resin, while others feel that this is unnecessary. One of the latter reports he had no indication of skin rash or any other such complaints from shirting after a year of operation.

Further information is obtainable from The Harshaw Chemical Company, 1945 East 97th Street, Cleveland 6, Ohio.

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Proxocream

Proxocream, a new textile softener, lubricant and antistatic agent, has been developed by The Procter & Gamble Co, Cincinnati 1, O. Outstanding sewability is said to be a feature of this new product. It is claimed that, when tested alongside another popular sewing assistant on a variety of fabrics, Proxocream was found to be from 8 to 50 percent more efficient depending upon the type of fabric with which it was used.

Just introduced by P&G, Proxocream is available as a concentrated white paste. It is nonionic in character, is said to have excellent scorch-resisting abilities, and to be nonchlorine retentive. This new product reportedly does not affect dye shades or fading rate and offers a high degree of compatibility in combination with products commonly used in dyeing or finishing operations.

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Veranthrene Yellow F3GC Powder Ultrafine

Verona Dyestuffs, Springfield Rd, Union, NJ, has added to its line a new vat yellow under the name of Veranthrene Yellow F3GC Powder Ultrafine, a homogeneous product said to be of extremely high lightfastness with excellent level dyeing properties.

This product reportedly produces a bright yellow and does not cannibalize blues in green combinations.

The lightfastness of this product after resin treatment (including reactant resins) is even slightly improved, it is claimed. Moreover, it reportedly possesses excellent all-round fastness properties.

So far this product is only available in powder form, but a paste type is expected at a later date.

Gloprint Conc WK-1 & WK-4

New Gloprint Conc WK-1 & WK-4 is termed an "exclusive" chalked up by Eastern Color & Chemical Co in that it is said to be the only all-aqueous printing extender-binder on the market developed expressly for printing on glass fabric.

Reportedly approved by Owens-Corning Fiberglas, the newest member of Eastern Color's Gloprint group is said to have passed wash tests, lightfastness tests, and other standard requirements "with gratifying success". A concentrated, high-molecular-weight resin polymer, it is a smooth, heavy white paste which is claimed to be readily soluble in water to afford an aqueous extender-binder paste for both screen and roller printing.

Softness is described by the manufacturer as excellent, and it is said that the fullest color value is obtained together with superior crock resistance. Like other members of the Gloprint Conc group originated by Eastern Color & Chemical Co, the new extender-binder for glass is said to lend itself to use with the oil-in-water system as well as all aqueous systems.

Printing pastes reportedly may be prepared with or without solvents, as conditions dictate. When solvents are used, up to 20% may be incorporated and a full-bodied oil-in-water printing paste is still obtained, it is stated.

Full details on properties and applications of Gloprint Conc WK-1 & WK-4 are available from Eastern Color & Chemical Co, 35 Livingston St, Providence 4, RI.

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Cowles Dissolver for "Through-the-Floor" Operation

New dissolvers, specially designed for "through-the-floor" operation to save space, have been announced by Morehouse-Cowles, Inc, 1150 San Fernando Rd, Los Angeles 65, Calif.

The new models reportedly may be mounted on upper floors, walkways, balconies, or other locations which permit the impeller to operate in tanks installed below floor levels. Production can be piped direct to lower areas for further processing or packaging, since many products can be completed on the Cowles without the necessity for milling, it is claimed.

They are designed to help in conservation of space under certain conditions, use of gravity transference of materials instead of by pumping, and simplification of processing arrangements.

Typical Cowles Dissolver "through-the-floor" installation

Available in 40 to 75 HP sizes, they are equipped with hydraulic lifts and "MPD" (maximum power delivery) drive systems. Hydraulic lift mechanism is constructed to allow cylinder to operate through floor, providing 48" rise of the mixing mechanism, to clear tanks.

Drive system is said to be capable of delivering over 90% of motor horsepower to impeller, even at slowest speeds. Speeds reportedly may be changed any time without stopping. Impeller can be swung in a 270° arc, allowing use of multiple tanks to speed operations.

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Vycron

Vycron, a new polyester textile fiber now on the market, embodies the combined efforts of The Goodyear Tire & Rubber Company and Beaunit Mills, Inc.

As a result, according to H R Thies, general manager of the Goodyear Chemical division, this newest polyester fiber is available for the first time this year in "wash-and-wear" summer suits and other article of men's, women's, and children's wearing apparel.

More than 20 leading clothing manufacturers, he said, are making garments from blends of the new polyester with cotton, wool, rayon, nylon and other synthetic fibers.

In "wash-and-wear" clothing, Thies stated, Vycron fabrics show exceptional resistance to wrinkling. A lower polyester content produces superior "wash-and-wear" performance and at lower cost to the consumer, he added.

Although all polyesters are noted for strength, Vycron is one of the strongest produced thus far, Thies pointed out. As a result, fabrics can be made lighter and sheerer without sacrificing wearing qualities.

From the moment manufacture of Vitel, the basic polyester resin, begins in Goodyear's new 10-million dollar plant at Point Pleasant, W Va, it is under tight check controls, Thies said. The same careful manufacturing controls continue at Beaunit's Elizabethton, Tenn, plant where the pellet-like Vitel is melted and spun into Vycron fiber.

Use of this new polyester will not be limited to clothing, Thies said. Special process yarns also are under development for upholstery and other decorative fabrics as well as industrial fabrics.

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Rezsoft NI

Metro-Atlantic, Inc, Centredale, RI, has introduced a chemically reactive nonionic softener for textile fibers. The new product, called Rezsoft NI, is described as a fully reactive, nonionic, nonchlorine-retentive, nonyellowing softener.

Chemically, the product is a nonionic ethoxalated long-chain alkyl hydroxylate ester, which is available both as a fluid, smooth white paste dispersible in warm water, and as a 100% material which is dispersible in water of 75 to 80°C.

Rezsoft NI is claimed to be an outstanding lubricant and antistatic agent for almost any textile application, and due to its nonionic nature is said to be compatible with almost all resins, catalysts and other finishing agents. Its characteristics are said to make the product attractive for high-quality "wash-and-wear," nonchlorine-retentive fabrics. Its use in conjunction with efficient resin dye-fixatives, for instance, reportedly produces a finish which has excellent colorfastness properties with good lubrication, which naturally improves the sewability and abrasion resistance. In mechanical operations such as embossing, schreinering and napping, where intimate metal-to-fiber contact is responsible for the end result, the lubrication obtained from Rezsoft NI is said to be outstanding. The superior antistatic and lubricating properties of Rezsoft NI are of extreme value in many weaving operations also, it is claimed.

Many additional uses are said to be possible. Additional information regarding Rezsoft NI is available from the Technical Service Department of Metro-Atlantic, Inc.

Improved Dyeing Process for Arnel/Cotton Blends

An improved method for the application of dyestuffs to Arnel/cotton blends reportedly has been developed by Albert V Morrell, superintendent of plant production for The Hellwig Dyeing Corp, Philadelphia, Pa. The Arnel/cotton combinations dyed by the method are used principally for women's wear and such men's wear as jackets and slacks.

Where combinations of Arnel and cotton are to be dyed, there is a problem of white reserve on Arnel, although it can be done using selected directs aftertreated with copper or cationic fixatives. Formaldehyde aftertreated directs usually stain Arnel markedly, however.

At the suggestion of Althouse Chemical Co, Reading, Pa, Mr Morrell tried a quantity of Azoanthrene Black WAN afer the desizing step. It is claimed that, where the Althouse dye was applied, there was no staining or bleeding, even when resin finishes were applied to the fabric. As a result this process and the use of Azoanthrene Black WAN, it is claimed, cleaning problem was eliminated. The machines reportedly can turn over faster and from two-and-one-half to three hours of washing time have been saved.

Since using the Althouse dye, Mr Morrell reportedly has never found it necessary to re-dye the fabric. He points out also that production of the plant can be increased as much as 20 percent with no additional labor.

Also, by fixing on the box with formaldehyde instead of cationic dye fixes, an additional saving is made. Should the dyeing process produce an uneven shade, it is said to be easy to remove the color.

The resultant product from this process is said to be a full blooming or full jet-black color with no staining of the Arnel. While the application of the black is the most recent development in this field, other color applications have been made. These include Scarlet WYLC, Yellow EFC, and Blue L, which are fast-to-light directs.

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Bottles of Teflon

Chemplast, Inc, 3 Central Ave, East Newark, NJ has announced the addition of one-piece molded bottles of Teflon to its Chemware laboratory line. These bottles, for storage and transportation of corrosive reagents, are available in one-, two, and six-liter sizes. The stopper and pouring spout are made of Teflon and fastened by a stainless-steel, screw-lock arrangement.

Chemplast bottles of Teflon

An exceptional degree of laboratory safety is said to be obtained with Chemplast's new laboratory bottles. They are tough and unbreakable at cryogenic temperatures and can withstand heat up to 600°F, it is claimed. In addition, they are said to be nonwettable, easy to clean, and noncontaminating. The bottles reportedly are completely unaffected by such corrosive reagents as aqua regia, hydrofluoric acid, sulfuric acid, nitric acid and all caustic solutions.

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Anotrol System for Controlling Corrosion

Continental Oil Company, Houston, Tex, has concluded an exclusive world-wide license agreement with Minneapolis - Honeywell Regulator Co, Minneapolis, Minn, to manufacture and market Conoco's electrochemical system for controlling corrosion.

The system, developed by Conoco scientists and to be marketed under the trademark "Anotrol," is intended to be offered initially for the control of corrosion in the storage and processing of sulfuric and certain other corrosive acids as well as corrosive caustics. It reportedly finds immediate application in storage tanks, tank cars, trucks, barges and process vessels exposed to such corrosives.

The Anotrol system reportedly represents a new approach to solving the problems caused by the storage and handling of such corrosive chemicals. Elimination of electrolytic corrosion by the use of Anotrol is said to improve product quality by ridding acids and end products of metal contaminants. It also is said to lead to lower maintenance costs, decrease capital investment by permitting use of less expensive materials of construction, and increase unit productivity.

Honeywell said manufacture and marketing of the system, which makes use of electronic circuitry, had been assigned to its Rubicon division in Philadelphia, Pa.

In principle, the Anotrol system is said to make mild steel or alloy steel internal surfaces of vessels resistant to such chemicals as sulfuric, phosphoric and nitric acids; sodium and potassium hydroxide; and aluminum sulfate and ammonium nitrate by developing a passive film on metal surfaces exposed to these corrosive liquids and maintaining this film with an electric current.

The passive film is formed by passing a direct current from a specially designed electrode (acting as the cathode) through the corrosive liquid to the vessel (acting as the anode). A controller supplies current to the system in order to maintain a predetermined voltage between the anode and a reference electrode.

The Anotrol system is the result of work in Conoco's research laboratories at Ponca City, Okla. Conoco first tested the unique system in a sulfonation unit at its Baltimore, Md, petrochemical plant for over a year and reportedly found that it substantially eliminated vessel and related piping corrosion during that period. Other successful installations of the system have been made at Conoco's Chicago, Ill, and Gretna, La, plants.

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Vinylstix Heat Seal

Development of Vinylstix Heat Seal, a new, water-based adhesive for dry-bonding supported and unsupported plastics, cotton, wool, leather, paper acetate and other materials, was announced recently by Adhesive Products Corp, 1616 Boone Ave, New York 60, NY. Materials coated with Vinylstix Heat Seal reportedly may be stacked and die-cut when the adhesive dries for bonding immediately or at a later date. A clean, strong, permanently-flexible bond to almost any surface can be obtained instantaneously merely by applying heat, it is claimed. Vinylstix Heat Seal is reported to be unusual in that it can also be used as a wet stick adhesive, if desired.

The product is said to be easily applied by spray, brush, roller coater, squeeze bottle or doctor blade and to dry rapidly to form an invisible, tack-free surface that will not discolor fabrics. Vinylstix is dry when materials are bonded. It may be used for attaching appliques and ornaments to curtains, sweaters, skirts and other garments in place of stitching, and for other decorative work.

Vinylstix Heat Seal is available in 55-gallon drums and in one- and five-gallon containers.

• NAMES IN THE NEWS •

Cline

Wica Chemicals, Inc, has appointed *Gene N Cline* as technical sales representative. Mr Cline is experienced in application of all products from Wica's latex division.

Mr Cline joined Wica in 1958 and has a record of achievement in quality control in the manufacture of Wicaloids, has headed up the Wicaloid division of the Wica Technical Service Laboratories, and has acted, previous to this appointment, as a customer consultant.

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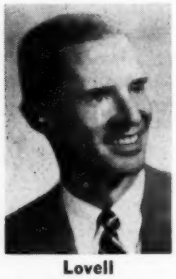

Lovell

James B Lovell has been appointed sales representative for the Central District of the Silicone Products Department, General Electric Company. His office location is 540 South 1st Street, Milwaukee, Wis.

Mr Lovell served as a regional marketing specialist in GE's Communications Products Department prior to joining the Silicone Products Department last year.

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Three major staff appointments to the Lowell Technological Institute Research Foundation have been announced.

Named technical director of the research and development division is *Paul J Angelo Jr*, who will have charge of all activities in this important section. Angelo has been assistant superintendent of the Marland plant of J P Stevens & Sons company in Andover.

Charles J Sadlier has been appointed computer programmer at the Foundation, and *Gary S Sales* has joined the organization as physicist.

Davis

G Daniel Davis, vice chairman of the board of directors of Nopco Chemical Co, was recently feted by Nopco's Fifteen-Twenty Five Year Employee Club at a testimonial dinner in honor of his retirement. The dinner was held in the Hotel Robert Treat, Newark, NJ.

Mr Davis joined Nopco as a shipping clerk in 1916 and in terms of total yearly service is the oldest Nopco employee. In 1920 he was given charge of the Chicago office and as a result of his outstanding sales and organizational work was assigned to expand the company's activities in other areas. Under his direction, new sales territories were opened in Canada, the South and New England. In 1923 he was elected secretary and director of Nopco and rose through the ranks to executive vice president where he was instrumental in guiding Nopco's development and growth.

In his retirement, Mr Davis will continue to be associated as director and vice chairman of the Board of Nopco Chemical Co.

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R A SHIMP

RICHARD A SHIMP, born in Alloway, NJ, December 26, 1905, died suddenly on the Woodbury, NJ, Country Club golf course Saturday, July 16.

He attended the Salem, NJ, public schools, graduating from high school June 1925. Subsequently he attended Temple University night school in Philadelphia for four years, majoring in chemistry.

In July 1925, he was employed by the Technical Laboratory, Dyestuffs Dept, E I duPont de Nemours & Co, Inc, Deepwater, NJ. He was transferred to the Philadelphia District Sales Office, Dyes and Chemicals Division, September 1, 1943.

Mr Shimp was active for many years in the Delaware Valley Section of AATCC as Councilor and as a member of various committees. He was well known by textile firms in Pennsylvania, New Jersey, Delaware, Maryland and Virginia.

Rosenstein

Harry Rosenstein has joined Kuppenheimer Clothes as director of research and development, with the objective of improving manufacturing processes, proceedings and techniques.

His previous position was with Bishop Freeman Co, of Evanston, Ill, where he did research and development on methods of garment finishing, including the designing of new equipment and products. He did intensive studies on natural fibers as well as synthetics.

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King

Assignment of *R B Huey* and *W R King* to the home office of The Goodyear Tire & Rubber Company's Division has been announced.

Mr Huey joins the polyester products department as senior sales engineer and will be concerned primarily with Vitel polyester resins produced for synthetic textile fibers. Prior to joining Goodyear, he gained extensive experience in the fields of textile and fiber research.

Mr King has been appointed sales engineer in the coatings department.

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Harlis E Martin, Charles W Pearce, and *Frank T Mountjoy* have been appointed technical service representatives for Oakite Products, Inc.

Mr Martin, formerly on the staff of a major dairy products manufacturer, has been assigned to Rock Island, Ill; Mr Pearce, an engineer and chemist, has been appointed to cover the Miami, Fla, area; Mr Mountjoy, for six years with an industrial refrigeration firm, has been assigned to the company's Kansas City, Mo, staff.

Donald P Feyler has joined the staff of the Textile Development Department at AviSun Corp as a specialist in end dyeing and finishing.

AviSun, a leading producer of polypropylene polymer, film and fiber, is an equally owned subsidiary of American Viscose Corp and Sun Oil Co.

Mr Feyler has been a member of the Dyeing and Finishing Division staff of the Technical and Textile Service Department at American Viscose Corp for the past six years.

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American Cyanamid Company's Fibers Division has named *Erwin G Walker* to the newly created post of sales manager, South. He will transfer to Cyanamid's sales office in Charlotte, NC, effective September 15.

The post of sales manager, South, is being established as the result of the need for increased service in this important textile area and expanding sales of Creslan acrylic fiber, The transfer of Mr Walker to the Charlotte Office is designed to strengthen the Fibers Division organization in the South.

Mr Walker joined Cyanamid in 1936. After serving in various sales capacities in North Carolina and Virginia, he was named manager of sales for the dyes department of Cyanamid's Organic Chemicals Division in 1954. In December, 1958, he was appointed sales manager of Fibers Division.

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The 1960-61 Ciba Company Scholarship, valued at $500, in the School of Textiles at North Carolina State College has been awarded to *Jean Antoinette Hamilton*, a member of the junior class at college.

Miss Hamilton has engaged in work in a laboratory at Burlington Mills.

Ted E Hager, senior in the School of Textiles, has been awarded a year's renewal of his Ciba Company Scholarship.

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Appointment of *Alvin E Jerome* as sales representative for the Polyco-Monomer Department of The Borden Chemical Co, a division of The Borden Co, has been announced.

Mr Jerome will be responsible for the sale of Polyco-Monomer's full line of synthetic resins in the New England states.

Prior to joining Borden Chemical in 1958, Mr Jerome was sales representative for the Modene Paint Co.

He will make his offices in Leominster, Mass.

Ford

Vance

Kirton

Glade

Weaver

The marketing organization for Tennessee Eastman Co and Texas Eastman Co, manufacturing divisions of Eastman Kodak Co, is being expanded through a recently formed International Division.

The new Eastman marketing division will be responsible for the sales and service of fibers, chemicals and plastics manufactured by Tennessee Eastman and Texas Eastman in all countries except the United States and Canada.

Eastman Chemical Products, Inc, will continue as sales agent in the United States and Canada for these products. This Eastman marketing subsidiary now has 20 offices in the United States and Canada.

James C White and *L K Eilers* are the chief executive officers of the Kodak units involved.

Sales and service activities abroad will be carried out by two subsidiary corporations which are being formed. One will be named Eastman Chemical International AG. This company, with headquarters in Zug, Switzerland, and a branch office in The Hague, Netherlands, will handle sales in Europe, the Middle East, and North Africa.

The second company will be known as Eastman Chemical Limited and will be based at Nassau in the Bahamas, with offices also in Hong Kong. Eastman Chemical Limited will be responsible for sales in Central America, South America, Australia, New Zealand, South Africa, and the Far East.

The Hong Kong office was opened on August 1. The Nassau and Zug, Switzerland offices will be opened early this month.

The International Division is under the direction of *Henry L Ford* as general manager. *Guy A Kirton*, formerly sales manager of ECPI's Chemicals Division, has been named assistant general manager.

The announcement also named *T E Vance* as manager for Eastman Chemical International AG at Zug, Switzerland; *Wiley H Weaver*, manager at Nassau for Eastman Chemical Limited; and *Paul Glade* as manager, Far East sales, for Eastman Chemical Limited at Hong Kong.

In setting up the overseas offices, *C S Soe*, Tennessee Eastman manager, insurance and taxes, is being given a temporary assignment at Zug, Switzerland. Soe will be responsible for administering the financial and accounting functions of Eastman Chemical International AG.

Others assigned to the European sales organization are: *David A Kressin*, who has been ECPI sales representative for a number of years at The Hague; *Paul J Wright*, now plastic sales representative in Kingsport; and *Ross Johnson*, service representative in the Chicago office of ECPI Plastics Division. Johnson has been appointed manager of European Plastics Technical Service with offices at The Hague. Kressin will continue as sales representative at The Hague. Wright will be sales representative at the Zug offices.

Carl S Whitlow, export sales coordinator, ECPI Chemicals Division at Kingsport, is being transferred to the Nassau office of Eastman Chemical Limited as sales representative. *Harold Dunlap*, Tennessee Eastman Credit Union accountant and treasurer, will be office manager at Nassau.

Additional personnel requirements will be filled, as far as possible, by citizens of the countries included in the sales territories.

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Wallace E Riffelmacher, of the Harchem Division of Wallace & Tiernan Inc, has been transferred from the Sales Department to the Product Develpmeont Department to assist *Bill Wiley*, product development manager, in the introduction of new plasticizers, dimer acids and epoxy additives.

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